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STUDIES IN PHILIPPINE DIPTERA, II

By M. BEZZI
(Turin, Italy)

ONE PLATE

Since the publication of the first paper of this series¹ I have received from Professor Baker very rich material, which enables me to continue these studies and to add some very important novelties to the already interesting oriental fly fauna. A second "century" is here offered, which will be quickly followed by others.

In the meantime some new species of Diptera have been described from the Islands, which are enumerated here with the object of completing the catalogue appended to the first century.

TIPULIDÆ

Geranomyia cornigera ALEXANDER, Insec. Menstr. (1913), 1, 137, from Pettit Barracks (Ludlow).

TACHINIDÆ

Bengalia, two unnamed species, BEZZI, Ent. Mitteil. (1913), 2, 75 and 78, from Los Baños (Baker).

PHORIDÆ

Aphiochæta variata MALLOCH, Proc. U. S. Nat. Mus. (1912), 43, 515, from Manila (Stanton).

CYPSELIDÆ (BORBORIDÆ)

Leptocera (Limosina) picturata MALLOCH, Proc. U. S. Nat. Mus. (1912), 43, 653, from Manila (Brown).

¹ See *This Journal*, Sec. D. (1913), 8, 305-332, for the first century.

ORTALIDÆ

Campylocera thoracalis HENDEL, Arch. f. Naturg. (1913), 79, 95, from Maao, Negros (Banks).

MILICHIIDÆ

Gitonides perspicax KNAB, Insec. Menstr. (1914), 2, 166, reared from *Pseudococcus* sp., Manila (Compere).

SECOND CENTURY OF THE BAKER COLLECTION

The first century of Philippine Diptera was based upon specimens from Luzon only. More recently Professor Baker has collected in islands other than Luzon, and for this reason localities are given for each species of the second century. Another series of Diptera, chiefly blood-sucking forms, has been received from Mr. M. B. Mitzmain, Alabang, Rizal Province, Luzon. This locality is about 35 kilometers from Los Baños.

✓ 101. *Plecia fulvicollis* Fabr. 1805.

Los Baños. A very common species spread over all the Oriental Region and extending also to New Guinea and Australia. It is very variable in size, one female specimen measuring only 4 millimeters in length, like an Indian one recorded by Brunetti.²

• 102. *Bibio rubicundus* van der Wulp. 1884.

Some females from Mount Banahao. Previously known only from Java. A very characteristic species, differing from *Bibio obediens* O. S. (New Guinea) in the yellow coloration of the wings; the antennal flagellum, wanting in van der Wulp's type, is black; on the contrary, the scape, which is said to be black, is yellow in the present specimens, as in *obediens*. The very long spur of the front tibiæ—about as long as the tibia—is dark reddish. The wings have the stigma pale yellow and rather broad; the second posterior cell is sessile at base.

103. *Culicoides judicandus* sp. nov.

Female.—Length of body, 1 millimeter. Near *C. molestus* Skuse of Australia and *C. guttifer* de Meijere of Java, but the wing pubescence very scanty and confined to the extreme tip of the wings. In this character it agrees with *C. pungens* de Meijere of Java; but the wing pattern is more like that of *guttifer*, from which it differs chiefly in having a clear spot at end of the subcostal cell, and in the fact that the clear marginal

² Fauna of Brit. India, 163.

spots are not in contact with the wing margin, but are placed at a little distance from it; the other spots are distributed as in *guttifer*. Neuration the same as in *guttifer*. Body brownish black, without distinct pattern. Legs dark brown, with the knees and the tips of tibiae and tarsi whitish yellow. Antennae short and blackish.

LUZON, Rizal, Alabang (*Mitzmain*). Mr. Mitzmain has used this gnat in experiments on the transmission of surra.

104. *Pselliophora suspirans* O. S. 1882.

Mount Maquiling. An endemic species. The present specimens differ from Osten Sacken's description in having a rounded yellowish spot between the middle and hind coxæ, of which the author does not speak; the collar shows a grayish spot in the middle; the wings show a trace of a yellowish tinge at base.

Key to the Philippine species of the genus Pselliophora Osten Sacken.

The genus *Pselliophora* seems to be rich in endemic Philippine species, some of which are very beautiful insects and are similar in general facies and coloration to some endemic species of the genus *Eriocera*. They may be distinguished as follows:

- a'. Tibiæ with a white basal ring; fourth posterior cell rather long, not much broader at base than at tip.
 - b'. Wings uniform black or blackish; head brown; thorax entirely black *dolens* O. S.
 - b'. Wings brown, with a white spot in the middle.
 - c'. Scutellum black.
 - d'. Collar entirely black or with only a grayish middle spot; femora black at base; abdomen with a single yellow band. *suspirans* O. S.
 - d'. Collar with a broad white spot in the middle; femora broadly yellow at base, at least those of the hind pair in the female; third and fourth abdominal segments with yellow spots. *suspirans hilaris* var. nov.
 - c'. Scutellum yellow; femora with yellow base; abdomen with segments 2 to 4 reddish yellow; genitalia black *idalia* O. S.
- a'. Tibiæ without white basal rings; wings uniformly blackish, with the fourth posterior cell short, twice as broad at base as at end; species of greater size.
 - e'. Thorax and legs entirely black *præfica* sp. nov.
 - e'. Thorax and legs partly orange-yellow *tripudians* sp. nov.

105. *Pselliophora suspirans hilaris* var. nov.

Very like *P. suspirans*, but distinguished by the more whitish than yellowish thoracic markings and by the more extended, whitish abdominal pattern.

Male and female.—Length of body, 12 to 13 millimeters; of wing, 12 to 13. Rostrum without brown spot in front. Collar

with a broad whitish spot toward the middle. Pleuræ with a rounded whitish spot between the last two pairs of coxæ. Scutellum black; mesophragma with a less distinct yellowish spot on each side. Halteres black, with the stalk yellowish toward the base. Abdomen with the pale crossband on the second segment as in *P. suspirans*, but besides with a broad yellowish band on the hind borders of third and fourth (in the male narrowly interrupted in the middle, in the female divided into two spots); also a smaller yellow spot on each side of fifth segment. On the venter all the segments after the second one with a broad yellow band at the hind border or a broad spot on each side; last segment in the male produced in the shape of a long, conical yellow protuberance. Male genitalia black and black-haired above, dark yellowish pilose below, with a yellow, longitudinal, middle stripe and two yellow tubercles at tip below. Ovipositor black, the terminal lamellæ dark yellow at tip. Hind femora in male narrowly, in female with the basal half, yellow. Wings as in *P. suspirans*; the triangular whitish spot at base of the two basal cells more developed; the first posterior cell usually stalked at base.

LUZON, Laguna, Los Baños and Paete (*Baker*).

106. *Pselliophora præfica* sp. nov.

An entirely black species, with unicolorous legs and wings.

Male.—Length of body, 15 millimeters; of wing, 16. Head black, but the underside of rostrum and a broad border at the hind margin of eyes reddish yellow; palpi black and black-haired; antennæ entirely black, with the appendices of flagellum provided with scanty dark pubescence. Thorax entirely black even on collar, scutellum, and mesophragma; dorsum rather opaque, pleuræ shining; the rather long hairs on postalar calli and scutellum black. Halteres black, with black pubescence on the stalk. Abdomen entirely black, even on center, with rather long black pubescence; genitalia entirely black and black-haired. Legs entirely black, even on the coxæ, and black-pubescent, hind femora distinctly thickened.

Wings uniformly darkened, with strong metallic reflections; squamæ black; basal pubescence of the axillary angle long, soft, and black. Veins black, but the basal vein of the discoidal cell appears whitish or somewhat light in color; first posterior cell sessile at base; fourth posterior cell short, much narrowed at end, more than twice as broad at base as at end.

MINDANAO, Butuan (*Baker*).

107. *Pselliophora tripudians* sp. nov.

Evidently allied to *P. præfica*, but distinguished by the bright rufous of head, thorax, and tibiæ. This very strikingly colored species seems to be allied to *P. incunctans* Walker of Celebes, *velutina* van der Wulp of Celebes, and *annulosa* van der Wulp of Java, but is different from these and from any other in coloration.

Female.—Length of body, 18 millimeters; of wing, 19. Head, with neck and rostrum, entirely bright rufous, with reddish or yellowish hairs and some scattered, long black hairs on occiput only; palpi rufous, with only the extreme tip of last joint deep black. Antennæ entirely rufous and with reddish hairs, only the scape below with black hairs. Thorax with collar, prothorax, and entire dorsum bright opaque rufous, with reddish hairs; pleuræ, scutellum, and mesophragma deep black, with black hairs. Halteres black. Abdomen entirely deep black, opaque, even on venter, with few and short black hairs; ovipositor shining black, with acute dark reddish terminal lamellæ. Front coxæ and trochanters rufous like the prothorax; front legs wanting in case of type; middle and hind legs with black coxæ and trochanters; femora black and black-haired, but their ends rufous and with reddish hairs; tibiæ rufous, reddish-haired, the extreme tips and terminal spurs black; tarsi black, but the prætarsi rufous at base. Wings exactly as in *P. præfica*.

LUZON, Laguna, Mount Maquiling (*Baker*).

The possibility is not excluded that the present species may be the female of *P. præfica*.

108. *Tipula umbrina* Wied. 1828.

A female of this species from Los Baños. It is known also from Sumatra, Java, Borneo, and New Guinea.

109. *Tipulodina cinctipes* de Meijere. 1911.

One female from Mount Maquiling, Luzon. This is a very distinct species on account of its vitreous wings and white-banded legs. It is perhaps the same as *Tipula pedata* of Osten Sacken's paper, but in the white ring of the front femora it answers better to the description of *T. cinctipes* from Borneo, known in the male sex only. The present specimen is larger, measuring 17 millimeters in length of body, 17 in length of wing, and 130 in spread of legs. The subcostal cell and a narrow streak along the fifth longitudinal vein are deep black; the fork formed by the first vein issuing from the discoidal cell is as long as its stalk, in contrast with de Meijere's description.

The genus *Tipulodina*, in my opinion, is to be placed in the subfamily Dolichopezinæ, and to this genus must be added other species besides *T. pedata* Wiedemann, like *magnicornis* Enderlein, *venusta* Walker, *inordinans* Walker, *gracillima* Brunetti, and *patricia* Brunetti.

110. *Megistocera fuscata* Wied. 1821.

A couple of specimens from Mount Maquiling. This is a very interesting species, known from Java, Sumatra, Celebes, Aru, and Borneo. The antennæ of the male measure 65 millimeters in length, but they are in some cases more than 80. A very instructive figure of the characteristic wing of the present species has been published.³

111. *Scamboneura dotata* O. S. 1882.

A single female from Mount Maquiling. Endemic. This may be the unknown female of Osten Sacken's species, or a different species. It differs from the description of the male in the following points: Frons entirely yellow, without middle brown line; joints of the flagellum entirely blackish; thorax entirely yellow, opaque, without stripes; scutellum and mesophragma entirely yellow, the latter paler; pleuræ entirely pale yellowish. Abdomen yellowish, with a darker, median longitudinal stripe; ovipositor shining reddish, with the terminal lamellæ straight and obtuse at end.

In the Javanese species, *S. quadrata* de Meijere, 1913, of which only the female is known, the thorax has three longitudinal brown stripes; *S. vittifrons* Walker, 1861, from Amboina, also known only from the female, has an ochraceous unstriped thorax, with two black dots on each side; in addition, the head, antennæ, and abdomen are differently colored. At present I think it better to consider the present specimen as the other sex of *dotata*, or at most as a variety, which may be named *S. dotata unicolor* var. nov.

Key to the Philippine species of the genus *Eriocera* sens. lat.

The genus *Eriocera* seems to be very rich in endemic Philippine species; those known to me may be distinguished as follows:

a'. Wings with only four posterior cells (*Eriocera* sens. str.).

b'. Antennæ of male enormously elongate, many times as long as the body; wings subhyaline in both sexes, with the anterior and poste-

³ Zool. Jahrb. (1912), 32, 30.

- rior cross veins placed on the same line with the basal vein of the discoidal cell verticalis Wied.
- b¹. Antennæ of male much shorter than the body; wings in both sexes infuscated with a whitish middle spot and with the above-named veins not in the same line.
- c¹. Hind legs of the usual shape; abdomen dilated, shining, with violaceous reflections and with some yellowish bands near the base. lativentris sp. nov.
- c². Hind legs distinctly thickened; abdomen not dilated and entirely black crassipes sp. nov.
- a¹. Wings with five posterior cells (genus *Physecrania* Big.).
- d¹. Legs black; abdomen with one or two yellow crossbands near the base; wings with black base and fore border..... mansueta O. S.
- d². Legs yellow, with black knees; abdomen with four yellow crossbands; wings with yellowish base and fore border. perennis O. S.

✓ 112. *Eriocera verticalis* Wiedemann. 1828.

A couple of specimens from Los Baños and Mount Maquiling. A very peculiar species, known from Java and Japan. The antennæ of the present male measure 45 millimeters in length.

✓ 113. *Eriocera lativentris* sp. nov.

Closely allied to *E. mansueta* Osten Sacken in coloration of body and wings, but at once distinguished by the abdomen being more than twice as broad and with the last four segments strongly shining and adorned with violaceous reflections.

Male.—Length of body, 11 to 13 millimeters; of wing, 10 to 12. Head covered with dense gray dust; antennæ with the two basal joints of flagellum more yellow. Thorax, scutellum, and halteres as in *E. mansueta*. Abdomen narrow at base, but becoming gradually broader, the sixth segment more than twice as broad as the second; abdomen clothed with black hairs; first joint entirely black; second yellow, with a black hind border; third black, with two narrow yellow crossbands at base; fourth black, with a similar band, but narrower; fifth to seventh entirely black, but with strong violaceous reflections. Genitalia yellow, with pale yellowish hairs. Venter black, with yellow crossbands on second, third, and fourth segments, that of second much broader than the others. Legs with the coxæ entirely black, but the front femora distinctly yellowish near the base; hind legs not thicker than usual.

Wing pattern as in *E. mansueta*, but the base narrowly yellowish; first vein issuing from the distal cell not forked; posterior cross vein distinctly before the middle of the discoidal cell; auxiliary vein ending opposite the marginal cross vein.

LUZON, Laguna, Los Baños and Mount Maquiling (*Baker*).

114. *Eriocera crassipes* sp. nov.

Closely allied to *Eriocera lativentris*, but very distinct.

Male and female.—Length of body (without ovipositor), 9 to 11 millimeters; of wing, 10 to 13; of ovipositor, about 5. Head dull black, with blackish dust. Antennæ entirely black. Thorax and scutellum opaque, not at all shining as in *E. lativentris*; pleuræ black-haired, with some gray dust above. Abdomen broader than in *E. mansueta*, but narrower than in *E. lativentris*, entirely black in both sexes; last five segments shining, but destitute of violaceous reflections. Venter entirely dull black; male genitalia opaque, orange-yellow, with yellowish hairs; ovipositor orange-yellow, opaque, its terminal lamellæ very thin and acute, longer than the basal joint. Legs entirely black, even at base of the front femora; hind femora, and especially the hind tibiæ on the apical half, distinctly incrassate; hind tarsi shorter and thicker. Wings as in *E. lativentris*, but subhyaline at base of hind border; the middle spot broader and more whitish than yellowish; first vein issuing from discal cell not forked; auxiliary vein ending before the marginal cross vein; posterior cross vein on, or a little after, the middle of the discoidal cell.

LUZON, Laguna, Los Baños and Mount Maquiling (*Baker*).

In the case of the male type the discoidal cell is regularly open in both wings, coalescing with the second posterior cell; in the female it is quite normal.

115. *Eriocera* (*Physecrania*) *mansueta* O. S. 1882.

Los Baños and Mount Maquiling. This endemic species is closely allied to *E. bicolor* Macquart and *E. cingulata* de Meijere. There is sometimes a smaller yellow crossband also on fore border of the third abdominal segment. The legs are black. An immature male specimen from Mount Limay, Bataan Province, Luzon, has the fourth posterior cell divided by a supernumerary cross vein regularly in both wings.

116. *Eriocera* (*Physecrania*) *perennis* O. S. 1882.

Los Baños and Mount Maquiling. Endemic.

117. *Conosia irrorata* Wied. 1828.

Specimens of both sexes from Los Baños and Mount Maquiling. This characteristic species is widely spread over the Oriental Region—New Guinea, Australia, and Japan—as well as over the whole Ethiopian Region.

-118. *Mongoma pennipes* O. S. 1887.

One female from Los Baños. This delicate midge was first described from Borneo and was subsequently recorded from India, Ceylon, and Java.

✓119. *Trentepohlia pictipennis* sp. nov.

A pretty species, very near *T. speiseri* Edwards from Ceylon, but at once distinguished by the different wing pattern.

Male.—Length of body, 5 millimeters; of wing, 5.7. Head, palpi, and antennæ dark brownish, antennæ a little paler toward the base. Thorax on dorsum dark reddish brown, darker along the middle line; scutellum and mesophragma brownish; pleuræ blackish brown. Halteres pale yellowish, with darker stalk. Abdomen entirely black, even on venter, and a little shining; male genitalia small and black, terminating with two hooks curved upward. Coxæ entirely light yellowish, the tarsi darkened at end; front and middle femora without bristles at base beneath. Wings long and narrow, pale yellowish along the costa and hyaline, iridescent on the remainder; the brown markings are as figured by Edwards for *T. speiseri*⁴ with the following differences: The middle brown patch extended over the second longitudinal vein and from it a narrow fuscous border extending along the veins to the end of the anal cell; the brown apical patch not extended over the first posterior cell, which is hyaline in the middle, and has no clear spot in the middle of the second marginal cell.

LUZON, Laguna, Mount Maquiling (*Baker*).

120. *Styringomyia ceylonica* Edw. 1911.

Specimens of both sexes from Los Baños and Mount Maquiling. This strange insect is recorded from Ceylon, India, and Formosa; it is nearly allied to *S. didyma* Grimshaw from Hawaii and Java.

Key to the Philippine species of the genus Libnotes Westwood.

The genus *Libnotes* seems to be very rich in endemic species; those known from the Philippine Islands all have the marginal cross vein elongated, with the exception of *L. familiaris*, which is also found in Java; in this last island the opposite is the usual case. No species with punctate or variegated wings occurs in the Philippine Islands, so far as is known.

⁴ *Ann. & Mag. Nat. Hist.* (1913), VIII, 12, 204, fig. 2.

- α^1 . Marginal cross vein short, perpendicular, forming a right angle with the first longitudinal vein; base of second posterior cell more drawn inward than that of third; thorax ochraceous, with a middle, longitudinal black line; wings hyaline; legs yellowish..... *familiaris* O. S.
 α^2 . Marginal cross vein long, placed obliquely, seemingly the prolongation of the first longitudinal vein incurved toward the second.
 b^1 . Wings hyaline, with a more or less intensive yellowish tint; body entirely ochraceous, without black markings.
 c^1 . Wings with a very faint yellowish gray tint, only a little more infuscated at fore border and apex; bases of second and third posterior cells on the same line..... *opaca* sp. nov.
 c^2 . Wings with an intensive yellow tint and with a brown border around the apex; base of third posterior cell more drawn inward than that of second..... *marginalis* sp. nov.
 b^2 . Wings brown or blackish; body bright orange, with deep black markings; bases of second and third posterior cells on the same line; legs blackish.
 d^1 . Wings brown, with a distinctly darker apex; abdomen with only the tip black *termitina* O. S.
 d^2 . Wings uniformly blackish; abdomen almost entirely deep velvet-black *semperi* O. S.

121. *Libnotes opaca* sp. nov.

Entirely opaque orange-yellow, with the genitalia dark brown; wings hyaline, with a pale yellowish tint.

Male.—Length of body, 10.5 millimeters; of wing, 13. Head entirely yellow, with the rostrum brownish; palpi black; antennæ black, the scape and the first joint of flagellum somewhat yellowish. Thorax and scutellum uniform bright orange, entirely opaque, destitute of any black or brown marking. Halteres yellow, with brown knob. Abdomen colored like the thorax, even on venter; forceps brown, with the underplate dark yellow. Legs wanting in the type; coxæ and trochanters bright orange.

Wings with only a light yellowish tinge, with an elongated, less distinct, stigmatic grayish spot and the extreme tip a little darkened. Marginal cross vein prolonged, seemingly a continuation of the first longitudinal vein; discoidal cell much narrower at base than at end, hind cross vein placed on its middle; second and third posterior cells of the same length.

LUZON, Laguna, Mount Maquiling (*Baker*).

The present species is closely allied to *L. familiaris* Osten Sacken, differing in the prolonged marginal cross vein and in the opaque, unstriped thorax. Allied also to *L. rufa* de Meijere, but distinguished by the wings not being infuscated and by the base of the third vein not being margined with fuscous.

122. *Libnotes marginalis* sp. nov.

Very near *L. opaca*, but of greater size and distinguished by the wings being yellowish and bordered with black at tips.

Male.—Length of body, 11.5 millimeters; of wing, 14.5. Head and rostrum yellow; palpi and antennæ as in *L. opaca*. Thorax, scutellum, halteres, and abdomen as in *L. opaca*. Genitalia with yellow, not brown, forceps. Legs wanting in the type. Wings with a strong yellowish tinge and a broad black border, extended from end of first vein to the base of fourth posterior cell; marginal cross vein elongated; discal cell a little shorter than in *L. opaca*; third posterior cell at base longer than the second, the veins, therefore, not on the same line as in *opaca* and exactly the opposite of the condition in *familiaris*.

LUZON, Laguna, Mount Maquiling (*Baker*).

✓ 123. *Libnotes termitina* O. S. 1882.

One male from Mount Maquiling. Endemic.

✓ 124. *Geranomyia argentifera* de Meij. 1911.

One female from Mount Maquiling. Known only from Java; a very distinct species on account of the hyaline wings and the silvery patches on frons and thorax.

✓ 125. *Wallacea argentea* Dol. 1858.

Los Baños. A well-known species, widely distributed over the Oriental Region to New Guinea.

In case the generic name *Wallacea* Doleschall, 1858, is preoccupied by *Wallacea* Baly, 1858 (Coleoptera, Hispidæ), the name *Gabaza* Walker, 1859, must be employed in its place.

✓ 126. *Atherix limbata* O. S. 1882.

Mount Maquiling. The undescribed male of this endemic species is very much like the female; the eyes are united for a long distance; the antennæ and the proboscis are lighter yellow; the palpi are yellow and clothed with a shining white dust. The coloration of the abdomen is exactly the same as in the female; the entire last segment and the sides of the penultimate segment are reddish; genitalia erected, pale yellowish, whitish at end. Legs and wings as in the female.

127. *Atherix fascipennis* sp. nov.

The present species belongs to the oriental group of species distinguished by the body being wholly black, at least in the female, like *A. cincta* Brunetti, *A. lucens* de Meijere, *A. cærulescens* Brunetti, but it is possible that some unknown males of these species have a partly yellow abdomen, as described by me for the Formosan specimens of *A. cincta*.⁵ In the present species both sexes are completely black.

⁵ *Ann. Mus. Nat. Hung.* (1912), 10, 445.

Male and female.—Length of body, 10 millimeters in the male and 11 to 12 in the female; of wing, 8 in the male and 9.5 to 10.5 in the female. Head black, with gray dust on the occiput; eyes of the male united for a line shorter than in *A. limbata*; the frons in the male white-dusted above the antennæ and deep black on fore half, in the female narrow, gray-dusted at vertex to the ocelli, deep black on middle, white-dusted above the antennæ. Face white-dusted in both sexes, with the middle bulla more developed and more prominent in the female than in the male. Antennæ entirely black, with long, thin black arista; palpi black, white-dusted and black-haired; proboscis wholly black. Hairs of the head black on frons and vertex, white on the occiput and below.

Thorax entirely black, even on the humeral calli, in the male more intensively black and more shining than in female; pleuræ clothed with shining gray dust and with whitish hairs; the hairs on the dorsum entirely black in the male, whitish on the hind half in female; above the humeri there is inward a narrow velvety black patch, more distinct in female than in male; metapleuræ with thin and soft white hairs. Scutellum black, in the male shining and black-haired, in the female gray-dusted and whitish-haired. Mesophragma black, gray-dusted on the sides. Halteres black, their stalks yellow at base.

Abdomen in both sexes entirely black, shining, even on venter; the first two segments in the female gray-dusted, in both sexes the two last segments with a broad triangular spot of white dust on the upper side; abdominal hairs mainly whitish. Male genitalia black and black-haired. Legs with the coxæ black; middle tibiæ dark yellowish; four posterior femora with a yellow ring at end, which is narrow and less distinct in the male, broader in the female.

Wings of the male with the basal half faintly yellowish hyaline, the apical half infuscated, more intensively infuscated toward the middle and thus forming a dark crossband below the stigma, which goes below the discoidal cell, the inner angle of the second submarginal being hyaline. In the female the wings are hyaline on the basal half, being only yellowish along the costal cell, and brown on the apical half; from the hyaline inner angle of the second submarginal cell begins a hyaline band which ends in the fourth posterior cell and, therefore, divides the dark part into two bands, united above and below; in the first basal cell there is a dark band before the root of the third longitudinal vein. Stigma brownish in both sexes. Venation as in *Atherix limbata*,

but the cubital fork is distinctly longer and provided with a shorter stalk.

LUZON, Laguna, Los Baños and Mount Maquiling; Tayabas, Malinao (*Baker*).

Genus SCHIZELLA novum

This new genus of the family Rhagionidæ (Leptididæ) is erected for a small fly that shows the general appearance of a *Chrysopilus*, differing in the form of the proboscis and chiefly in the extraordinary development of the third antennal joint; the latter character is noticeable because of the usual smallness of the antennæ in *Chrysopilus*. This elongated third joint is besides divided into two branches, forming a fork, a thing not rare in the family Tabanidæ, but never observed in the Rhagionidæ. The terminal style, which is long in *Chrysopilus*, is rudimentary in the new genus.

The principal characters of the new genus are as follows: Head as in *Chrysopilus*, but distinctly more transverse, facial bulla greatly developed and produced below, palpi small; proboscis with the terminal flaps much dilated, forming a sort of blister as great as the facial one, minutely transversely rugulose. Antennæ with the two basal joints small and short; third joint enormously developed, longer than the breadth of head, and divided into two branches from the root; the upper branch is a little shorter, but not narrower than the inferior one, which bears at its end a short, almost rudimentary style (Plate I, fig. 1). Eyes of the female without a trace of division; male unknown. Thorax, abdomen, and legs as in *Chrysopilus*; hind tibiæ with a single spur at end, the external one. Wings with the venation exactly as in *Chrysopilus*; anal cell closed and provided with a short stalk.

Type, *Schizella furcicornis* sp. nov.

128. *Schizella furcicornis* sp. nov. Plate I, fig. 1.

A small dark reddish and brown species with pale legs and grayish wings, which are a little spotted toward the middle.

Female.—Length of body, 5 millimeters; of wing, 4.7; of antennæ, 1.2. Head black, gray-dusted on the occiput and on the sides of the frons; facial bulla pale yellowish, white-dusted; palpi blackish; proboscis with whitish flaps; antennæ with the two basal joints yellowish, the third brownish. Thorax dark reddish brown, the pleuræ paler and clothed with whitish dust; it is entirely bare, even on metapleura, but it seems that on the hind part there is a short pubescence, with metallic reflections.

Scutellum brownish. Halteres pale yellowish. Abdomen blackish, rather shining, unicolorous, with short and few black hairs. Coxæ and femora pale yellowish; tibiæ and tarsi pale brownish.

Wings grayish hyaline, iridescent, with brown veins; stigma of greater size, dark brown, filling up completely the end of the marginal cell. Below the stigma a short dark band, ending on base of the cubital fork; below this band a small dark spot at end of the discoidal cell; besides, the apex of wings is broadly but faintly infuscated. Cubital fork very long and narrow, gradually broadened toward the end, its upper branch being bent at right angles at base and there provided with a short stump. Second posterior cell acute at base, narrow, and short, not broader and distinctly shorter than the third posterior cell; anterior cross vein short, placed near the base of the discoidal cell.

LUZON, Laguna, Mount Maquiling (*Baker*), one female.

129. *Chrysopilus luctuosus* Brun. 1909.

Male specimens from Mount Maquiling. They agree with the specimens from Formosa, referred by me^{*} to the present species, described from Assam.

Of the typical endemic species *Chrysopilus correctus*, recorded in the first century as No. 12, there are also specimens from Malinao, Tayabas, and from Butuan, Mindanao. The wing pattern seems to be variable in shape, remaining, however, of the same type; in the Butuan specimens the wings have a yellow tint, which is less developed in other specimens. In the undescribed male the thorax and the scutellum are clothed with shining metallic tomentum. The eyes are united, but there is no distinct differentiation between upper and lower areolets, a character somewhat aberrant in *Chrysopilus*.

130. *Chrysopilus diplostigma* sp. nov.

A small black species, distinguished by the peculiar abdominal pattern and by the enlarged stigmatic spot of the wings.

Male.—Length of body, 5 millimeters; of wing, 5. Head black, dark gray-dusted on occiput and face; eyes bisected, united on a long line; ocellar tubercle very prominent, bare; antennæ short, entirely black, with long, rather thick style; facial bulla shining black, ovate, gray on the sides; proboscis and palpi black, the latter black-haired. Thorax velvety black, rather shining, gray-dusted on sides and on the pleuræ; a trace

^{*} *Ann. Mus. Nat. Hung.* (1912), 10, 449.

of golden tomentum on dorsum; thorax entirely bare, with some black hairs on the metapleura. Scutellum like the thorax; meso-phragma black, gray-dusted, with black hairs on the sides; halteres black, the stalk yellowish at the base. Abdomen black and black-haired; strongly shining, even on venter; the tergites have at base a broad velvety black band, which on the terminal segments is reduced to a middle spot; genitalia black and black-haired. Coxæ black, with black hairs; femora black, with narrowly yellow tips, and the four posterior ones with yellow bases, broadest on the hind pair; tibiæ and tarsi long and dark yellowish; terminal spurs yellow.

Wings grayish hyaline, with a faint yellowish tinge; stigmatic spot broad, elongate, dark brown, filling up the entire end of the marginal cell; in addition, and in contact with the stigma, the end of the subcostal cell is dark brown, beginning at the end of the auxiliary vein. The rest of the wing immaculate. Cubital fork only a little longer than its stalk, destitute of appendix at base; second posterior cell acute at base and longer than the third; the last shorter than the discoidal cell. Squamæ pellucid brown, with pale fringe.

LUZON, Laguna, Los Baños (*Baker*).

✓131. *Mydas fruhstorferi* van der Wulp. 1896.

Mount Maquiling. Two female specimens, which answer perfectly to the description of the species from Java. Species of the present genus seem to be very scarce in the Oriental Region, only two others being known: namely, one from India (*ruficornis* Wiedemann) and one from Celebes and Sumatra (*basifascia* Walker); but I have in my collection a species from Ceylon that differs from all the others in being entirely black with the last three abdominal segments wholly rufous.

132. *Leptogaster princeps* O. S. 1882.

Specimens from Mount Banahao. A very distinct, endemic species, which may be considered as gigantic in its genus.

133. *Saropogon rubricosus* sp. nov.

Very near *S. jucundus* van der Wulp, 1872 (*vertebratus* Bigot, 1878), from Java and Sumatra, but distinguished by the wholly rufous abdomen and hind legs. The apical spur of the front tibiæ is very small and easily overlooked; thus van der Wulp has described this species as belonging to *Habropogon*, and Bigot placed it in *Scylaticus*, a fact recently noted by de Meijere, who has described another allied species from Java.

Female.—Length of body, 11 millimeters; of wing, 10. Head black, with pale reddish face; the occiput clothed with dense whitish dust near the eyes; frons shining on the middle and white at the eye borders; face clothed with dense whitish dust with a yellowish sheen. Antennæ entirely black, the first two joints with black hairs, the third linear, longer than the first two together. Mystax formed by only four pale yellowish bristles; proboscis and palpi black, the latter with yellowish hairs, ocellar bristles black. Thorax and scutellum entirely shining reddish, only the humeral calli with a broad shining black spot; collar with yellowish bristles and a brown spot on each side; macrochætæ black, those of the dorsocentral rows rather long and much produced over the suture; pleuræ with scanty yellowish tomentum; metapleura with yellow bristles. Scutellum with two strong black apical macrochætæ; mesophragma reddish, gray-dusted. Halteres yellowish.

Abdomen cylindric, of the same color as the thorax, shining above, opaque on venter, destitute of any dark marking, its hairs entirely pale; spines of the ovipositor red. Legs with the coxæ entirely reddish, only a small ring on the trochanters and on the knees being black; their hairs and bristles entirely reddish; hind femora with a single long bristle below near the base. Terminal spur of front tibiæ black, small, curved, distinct only at the outer side; claws black, with narrowly red base; pulvilli yellow.

Wings hyaline, with a faint yellowish tinge; veins brown; fourth posterior cell widely open at end; anterior cross vein on the first third of the discoidal cell; second longitudinal vein perfectly straight at end.

LUZON, Tayabas, Mount Banahao (*Baker*).

134. *Saropogon specularis* sp. nov.

A pretty, variegated species of small size, distinguished by the glistening, specular sternopleura. This cannot be the male of *S. rubricosus*, as is shown by the different mystax, different spur of front tibiæ, and more numerous spines of the hind femora.

Male.—Length of body, 9 to 10 millimeters; of wing, 8.5 to 9. Head entirely black, clothed with gray dust on the face, on the sides of the frons, and on the occiput; ocellar and occipital bristles black; antennæ entirely black, the two basal joints with black bristles, the third joint linear, almost twice as long as the first two together. Mystax formed by eight or nine yellowish

bristles, disposed in a single row at the mouth border; palpi black and black-haired; proboscis black.

Thorax black, with the humeral calli narrowly reddish; on the collar and on the dorsum clothed by dense dark ochraceous tomentum, without defined pattern; on the pleuræ the tomentum scantier and light gray, only the sternopleura being glabrous and shining black; bristles of the collar black; thoracic macrochætæ black, one præsutural, one anterior supra-alar, one posterior supra-alar, the dorsocentrals disposed on a line much produced forward, but shorter than in *S. rubricosus*. Metapleural bristles yellowish. Scutellum shining black, gray-dusted above, yellowish along the hind border, with a pair of strong black apical macrochætæ. Mesophragma black, densely gray-dusted. Halteres brownish yellow.

Abdomen distinctly spatulate, shining, with very short, dark and pale hairs; first segment black, with a narrow yellowish hind border and a strong black bristle on each side; second segment yellow, with a broad black basal band, the last produced behind on the sides; third segment yellow, with a triangular black spot at base on each side, sometimes less distinct; fourth to seventh segments black, with a yellow hind border, which becomes gradually broader on the last segments; genitalia black, with whitish pubescence; venter black, the second and third segments almost entirely yellow, with rather long, pale yellowish hairs. Coxæ shining yellowish, the posterior four with a broad black spot outside and the front pair with long whitish hairs; all the trochanters reddish yellow; all the femora black, strongly shining, with reddish tips, with some pale hairs, and those of the hind pair with four or five strong black bristles at end below and before; tibiæ yellowish, with long black bristles; spur of the front tibiæ black, stronger than in *S. rubricosus*, and not curved outward; tarsi dark reddish, with black ends; claws black, with red bases; pulvilli yellow.

Wings grayish hyaline, iridescent, with black veins; fourth posterior cell at end as broad as the second; discoidal cell narrow, the anterior cross vein placed near its middle; anal cell very narrow at end; second longitudinal vein distinctly bent forward at end.

LUZON, Laguna, Mount Banahao. MINDANAO, Butuan (*Baker*).

✓ 135. *Damalina semperi* O. S. 1882.

Mount Banahao. A very peculiar, endemic insect.

136. *Xenomyza vitripennis* O. S. 1882.

Numerous specimens of both sexes from Baguio, Benguet, and from Mount Maquiling, Laguna. The species seems to be very variable in the color of the legs, which varies from entirely black to entirely red or yellowish to variations of these colors. It was recently recorded also from Formosa, and the specimens from there were also very variable.

As the type of the genus *Damalis* was established by Westwood to be the South American species *D. curvipes* Fabricius, the name *Xenomyza* Wiedemann⁷ must be used for the oriental species.

137. *Epholchiolaphria vulcanus* Wied. 1828.

Butuan, Mindanao. This species is widely spread over the Malay Archipelago and is recorded also from Formosa. It is notable that in these Philippine specimens the bristles of the mystax are all yellow, instead of black, as they were originally described by Wiedemann. I refer them provisionally to the present species because of the great variability attributed to it.⁸

138. *Epholchiolaphria leucoprocta* Wied. 1828.

Los Baños and Mount Maquiling, Luzon. Even in these specimens the mystax is yellow instead of black. The present species is considered by Hermann to be only a form of *E. vulcanus*. But these Philippine specimens are well distinguished by the scutellum and the two basal abdominal segments being clothed with argenteous hairs, which in the female are of a golden color; on the second segment these hairs are present only at sides and at hind border.

139. *Epholchiolaphria partialis* nom. nov. (*partita* Walker, 1860, not of same author, 1857, Borneo).

Numerous specimens from Mount Maquiling, Laguna, and Malinao, Tayabas, Luzon, and from Cagayan, Mindanao. Described from Celebes, but recorded from the Philippines by Osten Sacken. It is very closely allied to *Laphria dimidiata* Macquart, No. 13 of the first century, which belongs also to *Epholchiolaphria* Hermann, and of which there are also numerous other specimens from Mount Maquiling, Laguna, and Malinao, Tayabas, Luzon; and from Dapitan and Butuan, Mindanao.

⁷ See Coquillett, *Proc. U. S. Nat. Mus.* (1910), 37, 530.

⁸ See Hermann, *Entom. Mittel.* (1914), 3, 107.

140. *Epholchiolaphria aurifacies* Macq. 1848.

Los Baños. Widely spread over the Malay Archipelago and usually referred to the genus *Maira*. These specimens answer also to the description of *azurea* Hermann, 1914, from Formosa.

141. *Smeringolaphria alternans* Wied. 1828.

Dapitan, Mindanao. Widely spread over the Oriental Region and recorded also from Formosa.

142. *Anisosis phalaris* O. S. 1882.

Mount Maquiling, Luzon. A very characteristic, endemic species. The name *Anisosis* Hermann, 1914, is preoccupied by *Anisosis* Deyrolle, 1857, in the Coleoptera.

143. *Orthogonis scapularis* Wied. 1828.

Mount Maquiling, Luzon. Widely spread over the Asiatic Archipelago to New Guinea.

144. *Pogonosoma cyanogaster* sp. nov.

This new species is closely allied to *P. bleekeri* Doleschall from Amboina and to *P. semifuscum* van der Wulp from Batjan, but is at once distinguished by the cyaneous white-pubescent abdomen. The recently described *funebre* Hermann from Formosa is also largely black and has black pubescence on the abdomen.

Female.—Length of body, 14 millimeters; of wing, 14. Head black, gray-dusted; ocellar tubercle shining black, with two long black bristles; occiput above with some black bristles, below with white hairs, which pass to the long white beard. Antennæ entirely black, the first two joints with long bristles, the third joint oval, as long as the first two together. Face with a very prominent, oval, shining black tubercle, which bears a mystax formed by from ten to twelve long black bristles; the remaining hairs of the face black below the base of the antennæ and white on the sides beneath. Palpi black, with short black hairs; proboscis black, very stout, of the characteristic shape for the genus, with long white hairs at the underside of the basal bulb and with short yellow pubescence at the end.

Thorax black, rather opaque, with faint metallic reflections and scanty whitish dust, without distinct stripes; bristles black; hairs black, but white on the sides and behind; collar gray-dusted, with numerous black bristles; pleuræ white-haired and white-dusted; a strong black bristle on the upper hind corner of mesopleura; metapleural tuft formed by white bristles. Scutellum like the thorax, but more metallic and with black bristles

at hind border; mesophragma black, gray-dusted. Halteres with blackish stalk and yellowish knob.

Abdomen entirely shining ceruleous, with short white pubescence; the hind lateral corners of segments two to five bear short, spotlike stripes of whitish tomentum; all the segments have on the sides rather long white hairs and two or three strong black middle bristles. Venter wholly shining ceruleous, whitish-dusted and white-haired at base, black-haired at end. Ovipositor with the first segment dark ceruleous and with long black bristly hairs at end, the second segment black with pale yellowish hairs. Legs shining, dark ceruleous, with long white hairs and with black bristles; coxæ black, densely gray-dusted; hind femora thickened, with a single, very strong black bristle beyond middle on outer side; middle femora with a long bristle before end on inner side; claws black, pulvilli dark yellowish.

Wings hyaline from base to middle, fuscous on the apical half, the inner border of colored area running from the fore margin of wing in front of the anterior cross vein to the hind margin at end of fourth posterior cell; the centers of the cells around the apex and the hind margin lighter. Discoidal cell shorter and narrower than the second posterior cell, the anterior cross vein situated on its first third; first posterior cell very long and narrow and rather narrowed at end; cross vein at end of the fourth posterior cell short and parallel with the posterior cross vein; stalk of the anal cell shorter than that of the fourth posterior cell. Veins black.

LUZON, Tayabas, Mount Banahao (*Baker*).

145. *Promachus forcipatus* Schin. 1868.

Los Baños and Mount Maquiling, Laguna, and Baguio, Benguet. A common endemic species, very characteristic by the extraordinary shape of the male genitalia.

146. *Promachus bifasciatus* Macq. 1838.

One female specimen from Cagayan, Mindanao. Known from Celebes and Java and new for the Philippines, but it is probably the species of which Osten Sacken says: "Resembles *bifasciatus* Macq., but is certainly different." The present specimen belongs surely to this species so far as can be judged from females only.

147. *Systropus* ⁹ *valdezi* sp. nov.

One female specimen from Baguio, Benguet. Named in honor of Julian Valdez y Hernandez, Professor Baker's Cuban collector.

* This generic name was misprinted in the first century, *This Journal*, Sec. D (1913), 8, 313.

Nearly allied to the species that in the first century, No. 17, I assumed to be *S. sphecoides* Walker, but differing in the pattern of thorax, which shows four yellow spots at the four angles of the dorsum, and in the legs being much more yellow.

Female.—Length of body, 16 millimeters; of wing, 13. Occiput black, gray-dusted; ocellar tubercle dark reddish; eyes less produced above, united for a distance as long as the frontal triangle; the latter blackish, white-dusted on middle, yellow below on the antennal tubercle; face pale yellow, with whitish hairs; jowls whitish with shining white dust and with hairs; mentum yellow, with long whitish beard. Antennæ black, the first joint narrowly yellow at base, with blackish hairs, more than three times as long as the second; third joint wanting in the type. Palpi yellowish; proboscis black, but reddish below on the apical half.

Thorax black, opaque, finely punctulate, with three less distinct, broad, longitudinal grayish stripes; humeral calli yellow, and above them a broad yellow stripe, which is produced inward, reaching almost the middle line of dorsum; on the postalar calli there is a broad, triangular yellow spot; pleuræ black, gray-dusted, with a yellow stripe from the humeri to the front coxæ. Metasternum black, with transverse furrows and long and dense pale yellowish pubescence. Scutellum like the thorax, with whitish pubescence at hind border; mesophragma black, with the usual yellow tubercles on each side. Halteres yellowish, with the knob black above. Abdomen provided with a long stalk, which is formed by the first three segments and besides by the basal part of fourth; it is entirely black, opaque, the four basal segments being dark yellow at sides and below. Front legs entirely yellow, but their coxæ black, like those of the other pairs; middle legs with black femora, which have yellow ends, and with yellow tibiæ and tarsi; hind legs with the femora black above, reddish below, and yellow at ends with the tibiæ yellow, but adorned with a broad black middle ring; prætarus yellow, with black end, the other joints black; tibial spines 8, 6, 6. Wings uniformly but faintly infuscated, a little more intensively at base and fore border; veins black.

LUZON, Mountain Province, Baguio (*Baker*).

Note.—The species believed to be *S. sphecoides*, of which there are also specimens from Mount Banahao, differs from *S. valdezi* only in the following points: The eyes are more produced above and are united for a line longer than the frontal triangle; the head, therefore, seems to be more acute above, viewed from before. The yellow stripes in front of the dorsum and the spots on

the postalar calli are entirely wanting or only indicated by a dark yellowish, less distinct trace; the metasternum is distinctly bluish, more furrowed, and less pubescent. The front legs have the femora more broadly blackish toward the base; the hind tibiæ are black, with narrowly reddish base and yellow tip; the hind tarsi are entirely black, the prætarsi being only narrowly yellow at base. The infuscation of the wings is more intensive.

148. *Toxophora zilpa* Walk. 1849.

One female specimen from Mount Maquiling. Described from China and not recorded subsequently; nearly allied to *T. javana* Wiedemann from Java, but it seems to be distinguished by the golden, not whitish, abdominal stripes and by the complete transverse band of the same color on the last abdominal segment.

149. *Petrorossia fulvula* Wied. 1821.

Numerous specimens of both sexes from Mount Maquiling and Malinao, Luzon, and Dapitan, Mindanao. Widely spread over the Oriental Region and known to me also from Formosa. The species was originally described as an *Anthrax* and was subsequently placed in *Argyramœba* by de Meijere, but it belongs without doubt to the present genus, being closely allied to the Ethiopian species *fulvipes* Loew and *gratiosa* Bezzi.

150. *Exoprosopa pennipes* Wied. 1821.

Los Baños. A characteristic species, widely spread over the Oriental Region, but not yet recorded from the Philippines.

151. *Melanostomus orientale* Wied. 1824.

Baguio, Benguet. This species, as redescribed by de Meijere, seems to be the oriental representative of the common *M. mellinum* Linnæus, and I am not sure if it may be considered as specifically distinct.

152. *Asarcina eurytæniata* Bezzi. 1908.

Mount Maquiling. These specimens are the same as my type from Malacca. *Syrphus striatus* of Osten Sacken's paper, page 115, and therefore *Asarcus consequens* of my enumeration in the first century, are almost certainly the same as the present species.

153. *Axona chalcopyga* Wied. 1830.

Dapitan, Mindanao. An immature specimen, in which the beautiful blue coloration of the mature insect is not yet developed. This is a very characteristic species, more like a *Volucella* than

an *Eristalis*; it is widely spread over the Malay Archipelago and was originally described from Manila, but subsequently has not been recorded from the Philippines.

154. *Milesia reinwardtii* Wied. 1824.

Baguio, Benguet. Known from Java, Malacca, and Borneo, but new for the Philippine Islands.

155. *Milesia conspicienda* Walk. 1860.

Butuan, Mindanao. The species already recorded from the Philippine Islands with doubt by Osten Sacken is without doubt the present species, which was described from Celebes.

156. *Milesia bigoti* O. S. 1882.

Los Baños and Mount Maquiling. An endemic species, very different from the last two and belonging to another group.

157. *Tricholyza sorbillans* Wied. 1830.

Mount Maquiling, Luzon; bred by Professor Baker from a cocoon of *Attacus atlas*. It is interesting to find this species living also in the Philippines, in as much as it is widely spread over the Palearctic, Ethiopian, and Oriental Regions. The species has received various names and has been bred from different Lepidoptera, being also known as a parasite of the silkworm.

158. *Sarcophaga ruficornis* Fabr. 1794.

LUZON, Rizal, Alabang (*Mitzmain*). The same as Indian specimens of this species in my collection, but I have not studied the male genitalia. This is a species of economic importance, which is known to produce severe forms of myiasis in India.

159. *Rhinia testacea* R. D. 1830.

LUZON, Rizal, Alabang (*Mitzmain*). Corresponding perfectly with Ethiopian specimens in my collection; known in the Oriental Region from the Nicobar and Key Islands.

160. *Thelychæta viridiaurea* Wied. 1824.

LUZON, Laguna, Los Baños and Mount Maquiling (*Baker*); Rizal, Alabang (*Mitzmain*). A beautiful species, originally described from India, which seems to be spread over the entire Oriental Region. New for the Philippines.

161. *Compsomyia dux* Esch. 1822.

LUZON, Laguna, Los Baños and Mount Maquiling; Benguet, Baguio (*Baker*); Rizal, Alabang (*Mitzmain*). Common in the

Orient. Originally described as a *Musca* and subsequently referred to *Lucilla*, or to *Chrysomyia*, or to *Pycnosoma*; but as Coquillett states that this species is the type of *Compsomyia*,¹⁰ it seems at present better to reserve this generic name for the species with enlarged areolets near the eyes of the male. They are prevalently oriental. The Ethiopian species of the group *marginalis* can retain the name *Pycnosoma*, and the Neotropical species of the group *macellaria* can retain that of *Chrysomyia*.

162. *Philæmatomyia crassirostris* Stein. 1903.

LUZON, Laguna, Mount Maquiling (*Baker*); Rizal, Alabang (*Mitzmain*). A common species, known from India and Java, but certainly spread over all the Oriental Region as well as the Mediterranean and Ethiopian Regions.

163. *Philæmatomyia inferior* Stein. 1909.

LEYTE, Tacloban (*Baker*); LUZON, Rizal, Alabang (*Mitzmain*). This species was described from Java; it seems to be widely spread in the Orient, like the preceding. It was first described in the genus *Musca*; but according to Patton and Cragg,¹¹ who have redescribed it under the name *gurnei*, it belongs to the present genus, notwithstanding the form of the proboscis, which on macroscopic examination seems to be very different from that of the type species.

164. *Stomoxys nigra* Macq. 1851.

Los Baños. This common Ethiopian blood-sucking fly seems to be widely spread in the Oriental Region, being recorded by Summers as one of the commoner species at Kuala Lumpur, Federated Malay States.

165. *Lyperosia exigua* de Meij. 1903.

LUZON, Laguna, Los Baños (*Baker*); Rizal, Alabang (*Mitzmain*). A common blood-sucking fly of the Orient.

166. *Mydæa duplicata* Meig. 1826.

Numerous specimens of both sexes from Baguio, Benguet. The only difference from the European specimens, that I can perceive, is that the female is darker and has darker legs and a little broader frons. The present species is not to be confounded with *M. duplex* Stein from New Guinea, which has only posterior dorsocentral bristles.

¹⁰ However, Brauer and Bergenstamm claimed, before the time of Coquillett, that the type of *Compsomyia* was *macellaria*.

¹¹ *Ind. Journ. Med. Res.* (1913), 1, 3.

167. *Orchisia costata* Meig. 1826.

Specimens of both sexes from Mount Maquiling, Laguna, and from Baguio, Benguet. This species is rare in central Europe, more common in southern Europe, and was described as *Cœnosia marginata* by Wiedemann from southern China. It was not without emotion that I found in Professor Baker's collection specimens of this pretty fly, identical with those which I find here in the alpine valley of Susa, near Turin, on swampy places, over *Mentha* and other aromatic herbage.

It is interesting to note that at Baguio, Benguet, are to be found three European flies: namely, *Melanostoma mellinum* (*orientale*), *Mydæa duplicata*, and *Orchisia costata*.

168. *Amphicyphus reticulatus* Dol. 1856.

Mount Maquiling. Identical with specimens from Calcutta, India, in my collection; described from Borneo as an *Ensimæ*, and subsequently recorded from Java.

169. *Campylocera thoracalis* Hendel, 1913, var. *rufina* var. nov.

Female.—Similar to the type of the species from Maaø, Negros (*C. S. Banks*), in the British Museum, but differing in the coloration of mesonotum. The four shining black longitudinal stripes are in the present variety of a shining reddish color, which sometimes is only very little darker than the surrounding parts, and therefore the stripes are hardly visible. Chætotaxy of head (not distinct in Hendel's type): Three ocellars, all bent forward; one superior fronto-orbital, bent forward; one post-vertical, diverging outwardly; one inner vertical, directed inwardly; one outer vertical, smaller and directed outwardly.

LUZON, Laguna, Mount Maquiling (*Baker*).

Genus TYLOPTERNA novum

This genus is erected for an aberrant ortalid, which shows a very extraordinary appearance, having only a remote resemblance in the shape of head to the Ethiopian genus *Pteragenomyia* Hendel, which is assigned by its author to the tribe Trapherinae.

Head broader than the thorax, truncate anteriorly, being in profile view exceedingly narrow, while in front view it has the aspect of the specimen figured by Hendel,¹² but it is less produced upward. Head broader than high, having more the shape of a

¹² Genera Insectorum, Platystominae, Plate III, fig. 48.

rectangle than that of a trapezium. Occiput little convex and the neck short, the head, therefore, being close to the thorax. Frons broad, slightly concave, placed in the same line with the face, lower than the eyes; the ocelli disposed in a small triangle, being very close together, and placed on the middle of the vertical keel, almost at equal distances from neck and from face of antennæ.

Eyes bare, rather small, twice as high as broad. Face a little shorter than the frons, but considerably broader, the eyes showing a prominent angle inward on the line of the antennæ; face concave, not at all prominent even at mouth border, and on the sides produced into a short point below the under corner of eyes. Lunula linear, concealed. Antennæ very short, close together at base, inserted at middle of eyes, directed outward, the third joint almost circular and as long as the second; second with a bristle above at end; arista basal, long, thin, microscopically pubescent. Antennal furrows horizontal, directed outward, placed just below the dividing line between frons and face, and parallel with this line. Oral opening retreating, concealed behind the straight edge of mouth; prælabrum not visible; proboscis proportionally small; palpi dilated at end. Chætotaxy of head reduced to a single pair of vertical bristles, placed outward, near the eyes.

Thorax short, subquadrate, slightly convex; suture slightly caudad of middle, broadly interrupted; humeral calli prominent; pleuræ regularly convex. Thoracic chætotaxy not well distinguishable in the type, only the anterior supra-alar being distinct, but rather thin. Scutellum of great size, as long as broad at base, flat, simple, with two pairs of bristles near the end. Mesophragma small, less convex, subquadrate. Squamæ rudimentary; halteres with a large knob. Abdomen short, narrower than thorax, and a little constricted toward the base; hypopygium ventral, of medium size. Legs of proportional size, simple; middle tibiæ without distinct apical spur.

Wings of great size, rather obtuse at end, hyaline, with black spots formed by rounded chitinous tubercles, and besides with a long strong spine (Plate I, fig. 2a) on lower surface in the second posterior cell. Veins bare; auxiliary vein very thin and less distinct; second longitudinal vein long, third and fourth rather sinuous, fifth very short, sixth wholly wanting; second basal and anal cells very narrow, narrowed to the base and almost indistinct.

It is possible that the peculiar chitinous black calli of the

wings, or at least the long spine of the underside, are found exclusively in the male; the female is at present unknown.

Type, *Tylopterna monstrosus* sp. nov.

170. *Tylopterna monstrosus* sp. nov. Plate I, fig. 2.

A curious little fly, of strange aspect and coloration.

Male.—Length of body, 2.8 millimeters; of wing, 3; breadth of wing, 1.2. Posterior part of head shining brownish, with a broad, rounded yellow spot beneath the vertex and with a broad yellow stripe at eye border, which unites below with the pale yellowish lower half of head. Anterior part of head whitish yellow, divided into two parts by a broad black horizontal line, which divides the frons from the face, and in which are placed the black antennæ. Arista pale yellowish. Proboscis yellowish, palpi whitish. Short pubescence of head whitish; vertical bristles black.

Thorax shining black, smooth, with reddish brown pleuræ; pubescence whitish, bristles black. Scutellum shining black, with the sides and the underside pale yellowish, mesophragma shining black; halteres whitish. Abdomen uniformly shining black, with whitish pubescence and rather long whitish hairs on the sides; hypopygium black; venter pale yellowish. Legs with the coxæ and the tarsi pale yellowish, but the hind femora and the hind tibiæ black, the last with yellowish ends; front and middle femora with a subterminal brown streak above; pubescence short, whitish.

Wings grayish hyaline, iridescent, with yellowish veins and colorless stigma. End of the marginal cell filled by a large deep black spot, which is at least in part callously chitinized. The two chitinous calli deep black, rounded, and placed near the hind border, the smaller before upper end of second posterior cell, the larger at lower inner end of same cell, just at the angle between posterior cross vein and last section of fifth vein. On the underside of wing a strong, straight, chitinous spine, placed on middle of second posterior cell, below the angle of the posterior cross vein with the fourth longitudinal vein and directed inward. This spine is black, but its broadened basal part is grayish hyaline, like the wing membrane; its length is about 0.5 millimeter.

LUZON, Laguna, Mount Maquiling (*Baker*), one male.

171. *Antineura sericata* O. S. 1882.

Cagayan, Mindanao. A beautiful endemic species of great size. The ortalid genus *Antineura* also may be considered as

endemic, as the other species are generically different and must be placed in *Adantineura* Hendel.

172. *Xenaspis polistes* O. S. 1882.

Malinao, Tayabas, Luzon, and Butuan, Mindanao. Another endemic and very characteristic species of great size, very much like a vespid.

173. *Xenaspis extranea* sp. nov.

This species is not unlike *X. polistes* Osten Sacken in general aspect and coloration, but differs in having the apical cross vein of the second basal cell less oblique. This fact is in relation with the other that the wings in the present species are not susceptible of being folded along the middle line as they are in *polistes*, which gives the latter its wasplike appearance. The present new species agrees with *polistes* also in lacking præscutellar bristles, but it has a well-developed mesopleural bristle.

Female.—Length of body (without ovipositor), 10 to 12 millimeters; of wing, 8 to 10; of ovipositor, 1.5 to 2. Head entirely reddish yellow, rather shining on the occiput, the latter with two small black parallel streaks on the middle, extending from the neck to the sides of the vertex; frons opaque, darker in the middle, with short yellowish pubescence; ocellar dot black; the two pairs of vertical bristles, the only macrochaetæ of the head, black; face pale yellowish in the middle, reddish on cheeks and on the sides below; antennal grooves with a long black streak at lower end. Antennæ a little longer than half the face, entirely pale yellow. Third joint somewhat attenuated at end, with a long, thin basal arista, which is shortly pilose above on the basal third. Palpi reddish, with darker base and yellow hairs; proboscis thickened and dirty yellowish brown.

Mesonotum entirely reddish yellow, darker on dorsum and with short yellowish pubescence; humeral calli, a longitudinal stripe above the notopleural line, a broad and oblique mesopleural stripe ending at the sternopleural suture, and two broad, contiguous stripes rounded by propleural spots yellow. Scutellum entirely yellow, with the base narrowly reddish brown; mesophragma shining reddish. Macrochaetæ black—two notopleurals, three supra-alars, one mesopleural, and one scutellar apical; sometimes exterior scapular bristles on one side only, the humeral always wanting; scutellum sometimes with two or three more bristles near the end; sometimes also a weak præscutellar bristle on one side only. Halteres yellowish. Abdomen longer than thorax, distinctly narrowed at base, but not properly stalked; it is entirely reddish yellow, with short yellowish pubes-

cence; the posterior part of first segment and the two following segments almost entirely occupied by a dark brown transverse band, which is sometimes interrupted in the middle, forming two broad blackish spots on each segment. Ovipositor broad, flattened, entirely reddish; venter blackish brown. Legs yellowish, coxæ reddish, tibiæ darkened, tarsi blackish at end; apical spur of middle tibiæ black.

Wings with a uniform yellowish tinge, which becomes brownish along the fore border from base to apex, where it is dilated to form an elongate spot, which surpasses the third longitudinal vein, reaching almost the fourth vein; third and fourth longitudinal veins slightly converging toward the end, the first posterior cell being, therefore, a little narrowed outwardly; anterior cross vein distinctly before the middle of the very long and narrow discoidal cell; apical cross vein of the second basal cell only a little more oblique than that of the anal cell, the last being perpendicular to the anal vein. Last two sections of the fourth longitudinal vein practically of the same length, second section considerably shorter than the third.

LUZON, Laguna, Mount Maquiling (*Baker*).

174. *Elassogaster plagiata* sp. nov.

A species with the facies of a *Stenopterina*, with complete thoracic suture, and with a small, oblique, anterior cross vein (almost as in *Elassogaster trivittata*), distinct from any other species of its genus because of the broad fuscous patch on wings in front of the posterior cross vein.

Female.—Length of body, 10 millimeters; of wing, 8. Head black, opaque, and deep black on frontal band, gray-dusted on face, and shining bluish on occiput, which shows a whitish-dusted border near the eyes. Vertex gray with two equal parts of strong, but short, black bristles; no other bristles on head. Frons with short shining yellowish pubescence along the middle line and above the antennæ. Antennæ inserted a little below the middle of eyes, shorter than the face; the two basal joints dark reddish brown; the third black, gray-dusted, obtuse at end, with a basal dark yellowish arista, which is shortly plumose on the basal two thirds. Prælabrum transverse, shining black; palpi and proboscis black.

Thorax and scutellum dull bluish black, the pleuræ a little shining and a little greenish, the sternopleura and a transverse band gray; bristles black, the scutellum with the apical pair alone. Mesophragma shining black. Halteres whitish, with the stalk black near the base. Abdomen of the same color as

thorax, with a soft white pubescence; the first segment with the basal part restricted to form a distinct stalk and black in the apical half, ovipositor blackish brown. Legs uniform bluish black with short gray dust; front femora not bristly below; spur of middle tibiae long.

Wings hyaline, with a faint yellowish tinge and with the veins black; costal cell brownish, subcostal cell black; at apex a short brown apical border, which begins as a very narrow line after end of second vein and, becoming gradually broader, ends at the fourth vein, where it is truncate and incloses a broad, subhyaline patch in the apical part of first posterior cell. The cross veins not infuscated; in front of and in contact with the posterior cross vein a broad fuscous band, which begins near the middle of first posterior cell and ends at hind border. Cross veins at end of second basal and of anal cell perfectly straight and placed on the same right line.

LUZON, Laguna, Mount Maquiling (*Baker*).

175. *Scelostenopterina femerata* Hend. 1914.

A single male specimen from Mount Banahao seems to belong to the present species, which was briefly described by Hendel from Sulu Island from a unique mutilated specimen in the British Museum.

Length of body, 9.2 millimeters. Antennae shorter than the face and entirely yellow. Abdomen very like that of *Stenopterina*, shining bluish green, white-pubescent, with two or three long, bristly black hairs on middle of the sides of first segment. Front coxae reddish, like the fourth anterior femora; all the tibiae and the tarsi dull black; hind femora shining bluish green.

176. *Pseudepicausta chalybea* Dol. 1858.

Dapitan, Mindanao, and Puerto Princesa, Palawan. Widely spread over the Malay Archipelago to New Guinea and already recorded from the Philippines as a *Stenopterina* by Osten Sacken.

177. *Scotinosoma typicum* sp. nov.

Hendel has revised this Loewian genus, which had been without a type, for an Australian species. But in the present collection there is a small fly which seems much better to agree with Loew's conception, being almost a *Rivellia* without sinuosity of the second section of the fourth longitudinal vein and with a very narrow marginal cell. The pattern of wings is the same as described by Loew; but it must be recorded that in the Oriental Region there are some species of true *Rivellia*, like *costalis* Hendel, which show an analogous pattern on wings.

Female.—Length of body, 3 millimeters; of wing, 3. Head entirely black, only the broad frontal stripes being dark reddish brown in middle and in front; frons narrower than an eye, with parallel sides or only a little narrowed near the antennæ; lunula deep black; antennæ free, inserted at the middle of eyes, shaped as in *Rivellia*, as long as the face, the third joint becoming gradually attenuated, with a basal, microscopically pubescent arista. Prælabrum greatly developed, but retracted, shining black; palpi and proboscis black. Bristles of head black, two pairs of fronto-orbitals directed backward, ocellar short, post-vertical small, two pairs of strong and long verticals, the inner pair converging; frontal hairs scattered.

Mesonotum longer than broad, little convex, entirely of a rather shining greenish color, more black on the pleuræ; the short hairs along the dorsocentral lines black and extended to the fore border; macrochætæ black, one humeral, two notopleurals, three supra-alars, one dorsocentral, but I cannot perceive a trace of mesopleural. Scutellum colored like the dorsum of mesonotum, bare, with four long black marginal bristles. Mesophragma shining black, with faint metallic reflections. Squamæ small, white; halteres yellowish.

Abdomen a little longer but not broader than the thorax, distinctly narrowed at base, scarcely punctulate, entirely shining black-aëneous, with a purple band at base of third segment; pubescence short and pale; venter dull black; ovipositor shining black-aëneous, flattened. Legs proportionally long, simple, entirely black, only the basal joints of all the tarsi dark reddish brown; apical spur of middle tibiæ well developed, black.

Wings hyaline, iridescent with a black fore border which fills the costal, subcostal, and the base of the marginal cell, ending at the apex of first longitudinal vein; besides there is an elongate, apical brown spot filling the extreme end of submarginal cell and extending a little over the third vein, where it ends truncately. Veins pale yellowish with the exception of the first three, which are blackish; first vein ending a little before the middle of wing and near to the costa; second vein rather short and near to the first and to the costa, the marginal cell being thus exceedingly narrow, almost linear, not broader than the costal cell; third vein long, ending at apex of wing, perfectly straight, the submarginal cell broader than the first posterior cell, which is faintly dilated at end; fourth vein entirely straight, without any curvature in the discoidal cell on its second section; fifth vein short, diverging; sixth extended to the hind border. Discoidal cell very short, of almost triangular shape; cross veins very close

together, the outer one placed after middle of discoidal cell, and its distance from the posterior considerably shorter than the length of the posterior cross vein itself; anal cell a little shorter than the second basal, its terminal vein a little bent outward in the middle.

MINDANAO, Dapitan (*Baker*).

178. *Rivellia hendeliana* sp. nov.

Nearly allied to the endemic species *R. fusca* Thomson, but at once distinguished by the second dark band of the wings being twice as broad, and very like that of the Ethiopian species, *R. latifascia* Hendel,¹³ but not reaching the hind border. Named in honor of Friedrich Hendel, of Vienna, whose marvellous work on the Ortalidæ, and chiefly on the Platystominæ, has rendered possible the determination of the beautiful flies of this family.

Male and female.—Length of body, 3.8 to 4 millimeters; of wing, 3.5 to 3.7. Head entirely black; occiput rather shining, with an argenteous border at eyes, which begins near the middle with a short horizontal line and is continued below to the chin; frons with the broad middle stripe dark reddish brown, more distinct in the male than in the female, and with a narrow argenteous lateral line, which is continued below on the narrow cheeks; face with whitish dust, shining black below; antennæ black, only a little dark reddish at base, with a dark, microscopically pubescent arista; prælabrum shining black; proboscis and palpi black, the last with narrow yellowish apical borders; bristles black.

Thorax and scutellum shining black, with faint dark gray pollen and black hairs and bristles; pleuræ and mesophragma shining black. Squamæ white; halteres yellowish. Abdomen entirely shining black in the female, with the base broadly orange reddish in the male; the short pubescence pale; male genitalia black with yellow penis; ovipositor dull black. Legs black, the tarsi entirely whitish in the male, with the last three joints blackish in the female. Wings exactly as in *R. fusca*, only second dark crossband is much broader than the two contiguous hyaline spaces and passes below the fifth longitudinal vein, ending toward the middle of the third posterior cell.

LUZON, Laguna, Los Baños (*Baker*).

179. *Loxoneura decora* Fabr., 1805, var. *bakeri* var. nov.

About the same as small specimens of *L. decora*, but distinguishable as follows:

¹³ Op. cit., Plate II, fig. 30.

Male.—Frons slightly but distinctly narrower; third antennal joint proportionally shorter and broader; antennæ considerably shorter than the face; mesonotum without anterior band of white dust; pleuræ destitute of shining white pollen. Tibiæ of male with no distinct tubercle above end.

In the wing pattern there are the two following considerable differences: *a*, the yellow patch at fore border is continuous, not at all interrupted by dark and hyaline spots; *b*, the brown pattern around the anal cell is much broader, extending as a broad band along the anal vein and reaching the hind border.

The sexual differences in wing pattern described by Hendel from Javan specimens are quite absent; thus the middle of the second posterior cell is wholly hyaline, without any oblique dark band; the brown border of the fifth longitudinal vein has below toward its middle no dentiform projection.¹⁴ The discoidal cell is completely infuscate only in its distal eighth part.

PALAWAN, Puerto Princesa (*Baker*).

180. *Lamprogaster placida* Walk. 1849.

Female.—A specimen from Butuan, Mindanao, answers rather well to the short original description of this endemic species, which is the only member of this very large oriental genus as yet found in the Islands; but Osten Sacken records another, unnamed species. The brown wing pattern consists in an irregular band at base of the first basal cell, continued below over the basal and anal cross veins; a narrow oblique band, which beginning at middle of the blackish brown stigma encroaches on the anterior cross vein and ends a little distad of the fourth longitudinal vein; a narrow, complete border of the posterior cross vein and a short streak at fore border just opposite to it ending a little before the third longitudinal vein; a narrow apical border which begins at the above-named streak and ends at apex of the fourth longitudinal vein. The abdomen is entirely shining metallic to the base; the legs are entirely black, even on the tarsi.

181. *Scholastes cinctus* Guér. 1832.

Numerous specimens from Los Baños and Mount Banahao. Already known from the Islands and very common in the Orient; recorded also from New South Wales.

Gorgopis cristiventris of the first century, No. 59, is now placed in the genus *Tropidogastrella* Hendel; there are specimens also from Mount Maquiling.

¹⁴ But in the male specimens of typical *L. decora* from Singapore in my collection these sexual characters are also absent.

182. *Zygænula paradoxa* Dol. 1858.

Mount Banahao, Luzon, and Butuan, Mindanao. A very curious fly, new for the Philippines, and previously known only from Amboina. The body is almost quadrate; the present specimens measure 5 to 5.5 millimeters in length and 3.6 to 4 millimeters in breadth. The species seems to be variable in coloration; in some specimens the entire occiput is black, while in others it is wholly reddish; the legs have the femora partly or entirely reddish yellow, or the four posterior femora are black on the basal half; the ovipositor is sometimes black, with bluish base.

183. *Naupoda unifasciata* sp. nov.

A small species, closely allied to *N. contracta* Hendel, from Formosa, and different from the typical endemic species *N. platessa*, besides the very different coloration, in having a pair of frontoörbital bristles, which are wanting in that species.

Male.—Length of body, 3 millimeters; of wing, 3.2. Head black; frons and face dark reddish brown, shining; frons about as broad as long, with parallel sides, with the eye borders very narrowly white and continued on the cheeks; face concave, with rather prominent mouth border; antennæ entirely reddish yellow, the third joint obtuse at end and shorter than the face, with finely pubescent arista; prælabrum short, not prominent, yellowish; palpi yellowish; proboscis brown; pubescence of the frons yellowish; bristles black; the single pair of frontoörbitals directed backward and weaker than the two pairs of equally strong but short verticals, the inner pair converging.

Thorax stout, as long as broad, shining black, finely and scarcely punctulate, with very short dark pubescence; bristles black and very short; pleuræ convex, smooth, glistening, black. Scutellum of great size, colored and punctulate like the dorsum, with a pair of very short, stout bristles near the end. Squamæ small, pellucid, brownish; halteres brownish, the knob blackish above.

Abdomen short, almost triangular, smooth, shining bluish black, glistening, with short and soft whitish pubescence; the two first segments raised, forming a triangular keel, very acute toward the middle. Coxæ and femora dark brownish, with short dark pubescence; tibiæ paler; front tarsi blackish, the posterior four entirely whitish.

Wings grayish hyaline, with a faint yellowish tinge; the base of the second costal cell in middle, the base of the first basal and the whole upper part of the second basal pale brown;

in the middle of wing a single, narrow, curved brown band, which begins at end of the first basal cell in front of the anterior cross vein, fills out the end of the discoidal cell, surrounds the hind cross vein, and ends at apex of the fifth vein; the upper half of this band darker than the lower half. A short pale brownish streak extends from the end of the first longitudinal vein to the middle of the submarginal cell. Anterior cross vein on the last third of the discoidal cell and near the hind cross vein, which is oblique and a little longer than the distance between the two transverse veins; last sections of third and fourth veins straight and almost parallel, the first posterior cell being only a little broadened at end; the section of the sixth vein after the anal cell longer than the apical cross vein of the anal cell. The entire wing surface strongly pubescent, the third longitudinal vein covered with long scattered hairs on its whole length. Discoidal cell a little longer than the second basal cell.

LUZON, Laguna, Mount Maquilang (*Baker*).

Key to the Philippine species of the genus Pterogenia Bigot.

It seems that this genus, although not yet recorded from these Islands, is represented by a great number of peculiar endemic species; at least I have found in Professor Baker's collection no less than six species, none of which can be referred to any of the twenty-seven oriental species included in Hendel's monograph.

α^1 . Scutellum entirely black.

b^1 . Frons as broad as an eye; mesonotum with yellow stripe on each side of dorsum, from suture to scutellum; a very robust species of proportionally large size, with only banded, not spotted, wings.

valida sp. nov.

b^2 . Frons narrower than an eye; mesonotum entirely black or only with a notopleural yellow stripe; smaller species, with banded and spotted wings.

c^1 . Occiput entirely black, even below, or only with a narrow yellow stripe on upper part; mesonotum without a yellow notopleural stripe *tristis* sp. nov.

c^2 . Occiput with a broad yellow postocular border; mesonotum with a yellow notopleural stripe *parva* sp. nov.

α^1 . Scutellum margined or striped with yellow, at least on sides.

d^1 . Frons broader than an eye; head broader than high; second abdominal segment with a longitudinal keel; legs entirely reddish; wings yellowish, not banded, and with numerous dark spots.

laticeps sp. nov.

d^2 . Frons narrower than an eye; head higher than broad; second abdominal segment without keel; legs mainly black; wings distinctly banded.

- e'. Scutellum black, with a narrow yellow hind border; no yellow stripes on dorsum of mesonotum or on sternopleura; wings distinctly yellow at base..... *luteipennis* sp. nov.
 e'. Scutellum yellow, with a black central spot; dorsum and sternopleura with yellow stripes; wings without yellow at base.
centralis sp. nov.

184. *Pterogenia valida* sp. nov.

A stout, short, and broad species, closely allied to the Bornean *P. dayak* Bigot, but easily distinguished by the black legs, the shortly plumose arista, and the compressed ovipositor.

Female.—Length of body, 8 millimeters; of wing, 8; breadth of body, 4.2. Head greatly developed, rather flat, about as high as broad, black with yellow markings. Occiput rather concave above, glistening black on middle, with a dull deep black border and besides with a complete yellow border, which is narrow distad of the vertical keel and near the upper eye border, but broader on the dilated and produced inferior part. Frons as broad as an eye, somewhat shining black on sides at vertex, opaque brown on the middle band, with a broad yellow border on each side, which is continued over the broad cheeks, ending with a point at some distance above the mouth border; face concave, black, shining on the antennal grooves, which are separated by a flat yellow keel; epistoma broad, blackish brown, prominent; jowls very broad, about one half as broad as the vertical diameter of eye, rugulose, black except the terminal points of the yellow stripes of cheeks and of occiput. Lunula black, dark yellowish on the sides. Antennæ short, much shorter than the face, entirely black; third joint gradually attenuated, but obtuse at end, with a basal, shortly plumose blackish arista, the total breadth of feathers being equal to the breadth of the third joint. Prælabrum very narrow, retracted, blackish; proboscis and palpi black, the latter very broad and provided with short dark hairs; a single pair of vertical cephalic bristles, the inner one black; the short and dense frontal pubescence black on the middle stripe and whitish on the yellow borders.

Mesonotum and scutellum shining black, but the first on dorsum appears to be less shining on account of the coarse punctulation; clothed with short black pubescence and provided with black bristles; scutellum bordered with about fourteen short bristles. A broad, faintly curved yellow stripe on each side of dorsum, extending from the suture to the scutellum; a broader, but shorter, yellow stripe extending from the small black humeral calli to the root of the wings. Pleuræ and breast entirely black, glistening, with rather long and dense black hairs.

Mesophragma shining black. Squamæ broad and long, pellucid grayish, with pale yellowish and whitish pilose borders; halteres pale yellowish, proportionally small.

Abdomen very short and broad, strongly convex in the middle, finely punctulate, with short dark pubescence and rather long black hairs on the sides; it is shining black, with bluish reflections on the sides. Second and third tergites with a narrow, but complete, yellow hind border; the third segment with the peculiar, triangular area of *P. dayak*, situated at middle of hind border and clothed by a soft, spongy membrane; fourth segment very narrow, entirely bluish; ovipositor short and black, its basal segment compressed, not depressed as usual. Venter black. Legs rather stout, entirely black even on the coxæ, and with black pubescence; femora only a little dark brownish near the base above; the two basal joints of all the tarsi whitish yellow and whitish pubescent, the last three joints deep black.

Wings grayish hyaline, distinctly yellowish along the costal cell. An irregular fuscous band extending over the base of the first basal cell and over the ends of the second basal and anal cells; a second rather broad brown band begins below the brown stigma and, passing over the anterior cross vein, ends a little after the fifth vein; along the costal border a series of three dark spots in the form of three abbreviated bands, which surpass only a little the third vein and are placed at the ends of the first, second, and third veins; the intermediate one of these spots sometimes continued to reach the more or less developed fuscous border of the hind cross vein. Anterior cross vein long, placed a little before the middle of the discoidal cell; third and fourth veins straight and perfectly parallel; anal cell a little shorter than second basal cell, its terminal vein being slightly curved outward.

LUZON, Laguna, Los Baños (*Baker*). MINDANAO, Butuan (*Baker*).

185. *Pterogenia tristis* sp. nov.

Very near *P. luctuosa* Hendel from Formosa, but at once distinguished by the much richer wing pattern.

Male and female.—Length of body, 5 millimeters; of wing, 5. Head as in *P. valida*, but the frons distinctly narrower, and the vertical diameter longer than the horizontal one, the jowls narrower. Frons yellow, with two black crossbands, one near the vertex including the ocelli and the other a little distad of the middle; these two bands dilated on the sides in the form of spots and united with a dark middle line; cheeks yellow and very

narrow. Face yellow, with a black middle spot, another smaller spot on each side below the black spot, and a narrow black line at mouth border; jowls only one third of eye, black, with a yellow spot near the eye; lower orbital border not dilated, black, with more or less extensive yellow spots. Antennæ much shorter than the face, black at base; third joint yellowish, with infuscated apical half; arista more shortly plumose than in *P. niveitarsis*, but longer than in *P. luctuosa*, the breadth of feathers being almost equal to the breadth of the third joint. Prælabrum narrow and blackish; palpi yellowish, black-haired; proboscis brown.

Mesonotum and scutellum entirely black, opaque, punctulate, with short black pubescence; dorsum in front with three less distinct longitudinal gray stripes. Mesopleura with a narrow, less distinct, longitudinal yellowish stripe. All the bristles black; scutellum with a single, long, apical pair, and near this four or five other pairs of much shorter bristles. Squamæ whitish, with pale yellowish border; halteres yellowish.

Abdomen shining black, smooth; second, third, and fourth segments in the male with a narrow yellow hind border, a little dilated toward the middle; male genitalia black. In the female the abdomen entirely black, at end only with a broad yellowish membranous patch at base of the ovipositor; the last with the basal segment depressed, black. Legs black, even on the coxæ; the four posterior tibiæ with a middle yellowish ring and yellowish bases, all the tarsi whitish, with blackish ends.

Wings with numerous dark spots on the basal half, a broad, middle brown band from stigma to the hind border interrupted on lower half by hyaline spots, and a broad, complete brown band from apex of the marginal cell to the middle of the hind border of the second posterior cell; in the hyaline space between these two bands a series of spots forming a narrow, irregular band united with the narrow fuscous border of the hind cross vein; in the hyaline apical part of wing there are also three or four dark spots, forming one or two irregular and shortened bands. First posterior cell distinctly dilated outward; anterior cross vein on the middle of the discoidal cell; anal cell much shorter than the second basal cell, with the terminal vein straight.

LUZON, Laguna, Mount Maquiling (*Baker*).

186. *Pterogenia parva* sp. nov.

Closely allied to *P. tristis*, but distinguished by the yellow notopleural stripe, the shining dorsum of mesonotum, and the longer plumose arista.

Female.—Length of body, 4 millimeters; of wing, 4. Head as in *P. tristis*, but the frons narrower and more elongate, being about twice as long as broad, and black with a narrow yellow vertical band; a broader yellow supra-antennal band; and two yellow spots before the middle. Yellow lower borders of eyes broader; face with only two black spots at end of the antennal grooves; third antennal joint entirely yellow; feathers of the arista twice as broad as the third antennal joint; praelabrum yellow; palpi black. Mesonotum and scutellum shining black, punctulate, with short black pubescence; humeral calli yellow, like a notopleural stripe extending to the root of wings; pleura altogether shining black and black-haired. Halteres yellowish.

Abdomen entirely shining black, even on the base of the ovipositor, smooth; ovipositor black, depressed. Legs black, but the hind tibiae almost entirely yellowish, without differently colored ring; tarsi whitish, with blackish ends.

Wings as in *P. tristis*, but the dark spots of the basal less numerous and with a distinct basal band before the anterior cross vein; fuscous border of the hind cross vein broader; the spots in the hyaline apical part less developed. Anterior cross vein a little beyond middle of the discoidal cell; anal cell much shorter than the second basal cell; cross vein at end of the second basal cell shorter than the second section of the fifth vein, which makes its lower border.

MINDANAO, Butuan (*Baker*).

187. *Pterogenia laticeps* sp. nov.

A robust species, which in the form of head and in general aspect is very like *P. dayak* and *P. valida*, but differs very much in coloration of body, legs, and wings; in the shape of the second abdominal tergite it shows an affinity with the Bornean *P. albovittata* Rondani.

Female.—Length of body, 7 millimeters; of wing, 6.5; breadth of body, 3. Head broader than high, yellow with black markings. Occiput above with a black transverse band between vertex and neck; frons broader than eye, as long as broad, with two black parallel crossbands, the broader one situated near the vertex and including the ocelli, the other narrower and placed distad of the middle, united to the preceding band by a black middle stripe; the short frontal pubescence black, like the single pair of vertical bristles; lunula shining black, frons opaque. Face broad, entirely dull yellow, a broad black spot, shining in the middle, just below the lunula and forming with it a single rounded spot at the root of antennæ; a narrow black semicircular line, interrupted in the middle and dilated in a spot on

each end, which divides the broad but flat epistome from the jowls. Cheeks yellow and much narrower than in *P. dayak*; jowls as broad as in *P. dayak*, as long as one half of the vertical diameter of eye, lighter yellow than the face, and clothed with numerous, short and dense black hairs; on the prominent and dilated lower occipital border are two small dark spots near the eye, above the inferior angle. Antennæ yellow and much shorter than the face, the two basal joints with a black spot on interior side; arista shortly plumose, the feathers being about as broad as the third joint. Prælabrum retreating, narrow, yellow, white-dusted; proboscis yellowish brown; palpi broad, yellow, with short and scanty blackish hairs.

Mesonotum and scutellum dull black, punctulate, with short black pubescence; on each side of the dorsum, from suture to scutellum, a rather narrow shining yellow stripe, curved outward at end and accompanied inward by a short yellow streak, in continuation with that of the scutellum; sutural calli yellow, conspicuously cutting into the deep black sides of dorsum; humeral calli yellow; a yellow stripe just below the notopleural line from humeral calli to the root of the wings. Pleuræ deep black, smooth, shining only on the posterior half, with dense and long black hairs and with a narrow yellow horizontal stripe on the lower half of mesopleura parallel with the notopleural stripe. Scutellum black, shining along the hind border, with four longitudinal yellow streaks; two longer, curved outward at end and situated on middle of the sides; two much shorter and paler, placed at apex. Thoracic and scutellar bristles black, scutellum with the apical pair alone, placed just in the middle of each apical yellow stripe. Squamæ whitish, with yellow border; halteres yellowish. First abdominal segment black, concealed below the very large scutellum; second segment black, with a complete reddish yellow stripe along the hind border and raised in the middle to form a very sharp keel, which is black before and reddish yellow behind; third segment reddish yellow, with narrowly black sides below and with a deep oval fovea in the middle, homologous with those of *P. dayak* and *valida*; fourth segment not visible; ovipositor short, depressed, black; venter yellowish on middle, black on sides.

Abdominal pubescence black on the black parts and golden on the reddish yellow parts. Legs stout, entirely reddish yellow; the coxæ, chiefly those of the front pair, broadly black behind; front femora with a brown longitudinal streak outside at base; all the tibiæ infuscated at end; the first joint of all the tarsi whitish, the others brown; the pubescence black.

Wings with a yellow tinge, which is more intense on the basal half and along the fore border; they have a few dark spots, arranged to form crossbands—a basal, less-defined one, a middle one more developed and double, and three others on apical part after the hind cross vein, which is narrowly bordered with fuscous along the inner side only. Veins yellow; third and fourth a little wavy, the first posterior cell dilated at end; anterior cross vein on middle of discoidal cell; second basal cell much longer than the anal one, its two apical cross veins being of about the same length; anal cross vein straight.

LUZON, Laguna, Los Baños (*Baker*).

188. *Pterogenia luteipennis* sp. nov.

A distinct species near *P. pectoralis* Hendel, from New Guinea, but at once distinguished by the yellow base of the wings.

Male and female.—Length of body, 5.5 to 6 millimeters; of wing, 6 to 6.5; breadth of body, 2.8 to 3. Head much higher than broad. Occiput black, with a complete yellow border which is narrow above and broader on the produced lower part, and there with a black spot, situated behind the inferior corner of eye. Frons narrow, length more than twice the breadth, opaque, dark yellow, with a basal and a middle crossband, united by a median longitudinal stripe. Lunula black, with a brown spot on each side between antennæ and eye. Face short, concave, continued below by the very broad epistoma, yellow, with a black transverse band at end of antennæ; cheeks narrow, yellow; jowls very broad, as broad as one half of eye, rugulose, yellow, with a broad black band, which is in continuation of that of face. Prælabrum concealed; palpi black; proboscis brown. Antennæ short; first joint black, second globular and red, third pale yellow; arista long plumose, the feathers twice as broad as the third joint.

Mesonotum and scutellum black, opaque, punctulate, black pubescent; three less distinct and irregular cinereous longitudinal stripes on dorsum, humeral calli yellow like the notopleural stripe; mesopleura toward the middle with a narrow yellowish stripe, which is cinereous-dusted above. Yellow border of scutellum complete, but narrow. Squamæ and halteres yellowish. Abdomen dull black, the second, third, and fourth segments each with a narrow yellow hind border, which is a little broadened in the middle; second segment without keel; male genitalia yellow; ovipositor short, compressed, brownish yellow; venter yellowish, black on the sides. Legs and coxæ black, the four posterior tibiæ with the basal half yellowish, and all the tarsi with the first joint whitish.

Wings rather long, with a strong yellow tinge along the fore border and on the basal half; on the basal half some dark spots and two broader dark bands, one intermediate and complete below the stigma, and the other surrounding the posterior cross vein; a dark stripe to the fourth vein in the hyaline space between the two bands and some uncertain spots in the apical hyaline part. Veins yellow, the third and fourth straight and parallel to the end; anterior cross vein a little before the middle of the discoidal cell; anal cell not much shorter than the second basal cell, with the terminal cross vein straight.

LUZON, Laguna, Mount Maquiling and Mount Banahao (Baker).

189. *Pterogenia centralis* sp. nov.

Allied to *P. luteipennis*, but distinguished by the very different coloration of mesonotum and scutellum.

Female.—Length of body, 5.5 millimeters; of wing, 5.5. Head as in *P. luteipennis*, the shining occipital yellow border without black spot in the dilated part; frons yellow, with an elongate, double reddish brown spot in the basal part; face with a rounded black spot at end of the antennal grooves and with a narrow black line, dividing the epistoma from the jowls without black crossband. Antennæ as in *P. luteipennis*, but the second joint black and the arista more shortly plumose, the breadth of feathers being only equal to the breadth of the third joint. Mesonotum and scutellum black, opaque, with dense shining yellowish pubescence; on dorsum a yellow stripe from the yellow humeri to the suture, curved inward at end, and another from the suture to the scutellum, a yellow notopleural stripe, and below this two broad, parallel yellow stripes—one on mesopleura, the other on upper part of sternopleura; hairs of pleuræ whitish and yellowish.

Scutellum yellow, with a basocentral, rounded black spot. Squamæ whitish; halteres yellowish. All the bristles black; on scutellum a pair of long apical bristles and some other pairs of shorter ones. Abdomen as in *P. luteipennis*, but the yellow hind borders of second and third segments broader; and the third segment with a middle longitudinal yellowish stripe; pubescence black, but yellowish on the yellow parts; ovipositor black, depressed; venter black, with black hairs. Coxæ black; femora reddish brown with blackish stripes below and behind; tibiæ yellowish with black ends; tarsi whitish, with the last three joints black. Wings whitish hyaline with only the extreme base less distinctly yellowish; three complete fuscous crossbands,

the first near base, the second below the stigma and crossing the discoidal cell, the third extending from apex of the marginal cell to the middle of the second posterior cell; the hind cross vein margined with fuscous only below and not included in a band, but above it from costa to a little before the fourth vein there is a dimidiate crossband in the hyaline space between the second and third crossbands; in the apical hyaline space some fuscous spots, forming one or two irregular crossbands. Veins yellowish brown, directed as in *P. luteipennis*, but the second longitudinal vein distinctly a little wavy, not straight; anal cross vein distinctly longer than that at end of the second basal cell.

MINDANAO, Butuan (*Baker*).

Key to the Philippine species of the genus Euprosopia Macquart (including Notopsila Osten Sacken).

The present genus also seems to be productive of endemic species in the Philippines. No one of the five species found by Professor Baker can be identified with any of the thirty-three species already known from the Oriental and Australian Regions: the group of the species with elongated antennæ (*lepidophora*, *longicornis*) seems to be peculiar to the Islands. The two species, *sexpunctata* and *curta*, described by Osten Sacken under the generic name of *Notopsila*, also belong here, but are wanting in the present collection; *Euprosopia curta* was recently recorded from Formosa by Hendel.

- α^1 . Scutellum emarginate, that is, distinctly hollowed at apex; arista bare; wings spotted.
 - b^1 . Face with six deep black spots..... *sexpunctata* O. S.
 - b^2 . Face without black spots..... *curta* O. S.
- α^2 . Scutellum not emarginate, convex at apex; arista shortly plumose; wings usually banded.
 - c^1 . Antennæ much shorter than the face, as usual.
 - d^1 . Mesonotum adorned with three broad longitudinal bands of yellowish tomentum, the middle of which is continued on scutellum and abdomen; front tarsi with yellow bases; wings distinctly yellowish, with fuscous spots..... *trivittata* sp. nov.
 - d^2 . Mesonotum and abdomen altogether black, without such stripes; front tarsi black; wings not yellowish and distinctly banded.
 - e^1 . Much larger; abdomen without white scales; front tarsi much dilated; wings with the second and third bands united with the broad fuscous border of the hind cross vein.
 - gigas* sp. nov.
 - e^2 . Much smaller; abdomen with scattered white scales; front tarsi not dilated; wings with only a single distinct band between the numerous dark spots..... *millepunctata* sp. nov.
 - c^2 . Antennæ as long as the face, or even a little longer; abdomen with scattered white scales; wings conspicuously banded.

- f'. Antennæ red; femora and tibiæ entirely and intensively black.
lepidophora sp. nov.
 f. Antennæ black; femora and tibiæ in part reddish brown or
 yellowish longicornis sp. nov.

190. *Euprosopia trivittata* sp. nov.

A very distinct species, suggesting *Plagiostenopterina trivittata* Walker by its coloration and seeming to be allied to *E. tigrina* Osten Sacken, from New Guinea, which, however, has a very different wing pattern and has no inner frontoörbital bristles.

Male and female.—Length of body, 5 to 6 millimeters; of wings, 5 to 6. Head oval, much higher than broad, entirely yellow; occiput with dense gray dust, which becomes paler on the dilated lower part; frons once and a half as long as broad, broader than an eye, distinctly broader in the middle than at the ends, the middle band clothed with short yellow hairs and with a narrow white stripe on the sides, with a middle longitudinal dark line; lunula yellow; two pairs of black vertical bristles; face whitish-dusted, above with a short dark longitudinal band between the antennæ, and below with two black spots at end of the antennal grooves; cheeks narrow, much narrower than the third antennal joint; jowls about one fifth of eye, yellow, with a less distinct brown spot. Antennæ entirely yellow, a little longer than one half of face; third joint attenuated, but obtuse at end, with a short, basal, plumose arista, the breadth of feathers being equal to the breadth of the third joint. Prælabrum convex, circular, shining yellow, with a black spot on each side; palpi dilated, deep black, the apical border shining whitish and the thin base broadly yellow; proboscis yellowish.

Mesonotum opaque, black, but almost entirely occupied on the dorsum by the three equally broad longitudinal stripes of yellowish tomentum; the short pubescence yellow on the yellow stripes and black on the black ones; the hind border of dorsum with a row of long yellow hairs before the scutellum; bristles black; pleuræ entirely clothed with yellowish tomentum, separated from the external stripes of the dorsum by the black notopleural band; hairs yellow and very long on the hind border of mesopleura and of pteropleura.

Scutellum black, convex at end, with the broad, middle yellow band exactly in continuation of that of dorsum; two pairs of apical black bristles, and rather long yellow hairs at hind border. Squamæ and halteres pale yellowish.

Abdomen entirely clothed with yellowish tomentum like the

mesonotum, but with a black longitudinal stripe on each side not reaching the hind border, and thus forming the three longitudinal yellow stripes, the middle of which is exactly in continuation of that of scutellum and mesonotum; venter yellow and brown, rather shining. Male genitalia black, rounded, retracted, with some short black and red appendages below and with a very long, spiral, shining reddish penis; ovipositor short, black, flattened. Legs yellow, with yellow pubescence; front coxæ mainly black; femora and tibiæ broadly black at end, sometimes the anterior femora and even the middle ones entirely black with yellow ends; basal joint of all the tarsi whitish.

Wings with a distinct yellowish tinge at base and fore border; covered with numerous dark spots, which are in part confluent, but without forming distinct crossbands; hind cross vein with a broad fuscous border, and in continuation with it a subobsolete band, interrupted by hyaline spots, which ends at apex of the first longitudinal vein. Third and fourth longitudinal veins entirely straight and parallel in their last sections; anterior cross vein oblique and placed near the middle of the very long discoidal cell; second basal cell longer than the anal, which is terminated by a straight cross vein.

LUZON, Tayabas, Mount Banahao (*Baker*).

191. *Euprosopia gigas* sp. nov.

In wing pattern very similar to *E. impingens* Walker, from New Guinea, but distinguished by its different coloration and by the presence of two pairs of vertical bristles.

Female.—Length of body, 12 millimeters; of wing, 12. Head higher than broad, with the frons and the face much produced over the eyes, but perhaps only because of an accidental compression of the type specimen. Occiput hollowed, yellowish, with two black stripes; frons narrower than an eye, about twice as long as broad, hollowed in the basal half and there yellowish red, prominent in the apical part and there black, with narrow yellowish sides; bristles black, the inner vertical pair only one half as long as the external pair; lunula dark brown; face pale yellow, with a black stripe on each side along the antennal grooves, which is continued below to the mouth borders, but becomes brownish in this part; cheeks black and brown, a little narrower than the third antennal joint; jowls brown, one fifth of eye in breadth. Antennæ black, the basal joint a little reddish outward, not longer than one half of face, with a long arista, which is shortly plumose at base, the feathers being as broad

as the third joint. *Prælabrum* narrow, subquadrate, shining yellowish; palpi less dilated, entirely black, with long black hairs; proboscis dirty yellowish.

Mesonotum dull black, densely punctulate, with short and thick black hairs, only in front of the scutellum with yellow hairs; bristles black, two or three anterior supra-alars; *pleuræ* black, gray-dusted, and with numerous rounded black points, with long, yellow hairs and some shorter black hairs on anterior part of mesopleura, sternopleura, and pteropleura. Scutellum flattened above, convex behind, reddish brown, darker at base, entirely clothed with shining yellow hairs, which are longer near the borders, and with three pairs of strong black apical bristles, the smaller, external pair being placed most distant from the border. Mesophragma black, smooth, rather shining; *squamæ* pellucid brownish with a whitish border; halteres yellowish. Abdomen black, finely punctulate, rather shining, with the last two segments brownish red; pubescence dark, the hind borders of the segments with longer whitish hairs; venter dull black, with whitish hairs on the sides; ovipositor black, flattened. Legs stout, brownish black, with black pubescence; front tarsi much dilated, entirely deep black; the basal joint of the four posterior tarsi whitish, with black ends. Wings destitute of yellowish tinge at base or fore border; the dark pattern is very like that figured by Hendel,¹⁵ but the first band is much broader; the second and third bands united with each other and with the broad border of the hind cross vein from the fourth longitudinal vein; the hyaline spaces between first and second bands and between second and third bands have in the middle two or three elongate brown spots, which form two narrow, interrupted stripes; the second posterior cell shows four or five dark spots along the hind border.

LUZON, Laguna, Mount Maquiling (*Baker*).

192. *Euprosopia millepunctata* sp. nov.

A small, dull blackish species, with a white-scaly abdomen and with a single dark crossband on the thickly punctuated wings.

Male.—Length of body, 4 millimeters; of wing, 4. Head blackish, a little higher than broad; frons with narrow dark yellowish lateral borders and with short yellowish hairs; two pairs of black vertical bristles; face dark yellowish on the middle, brownish on the sides, with a deep black spot at end of each antennal groove; cheeks brown, linear; jowls deeply rugose, reddish brown, one sixth of eye. Antennæ blackish

¹⁵ *Die Art. d. Platyst.*, Plate II, fig. 38.

brown, dark reddish at base, a little produced over the middle of face; arista shortly plumose at base, the breadth of feathers being less than the third joint. Prælabrum convex, circular, shining black; palpi black, with narrowly yellow base; proboscis dark brown. Mesonotum entirely dull black, with short and scattered yellow hairs, and in front with the beginning of two longitudinal gray lines, which do not reach the suture; pleuræ gray, with indistinct black points and with rather long yellow hairs at hind border of mesopleura. Scutellum like the dorsum of mesonotum, convex at end, with two pairs of apical black bristles. Squamæ brownish pellucid; halteres yellowish. Abdomen entirely dull blackish, the last two segments densely gray-dusted and with scattered whitish scales; genitalia retracted, black like the venter. Legs stout, black, the femora brown toward the base, four posterior tibiæ broadly yellowish in the middle; front tarsi entirely black, not dilated; basal joints of the other four tarsi whitish, with black ends.

Wings whitish hyaline, no yellow at base, with very numerous blackish dots and streaks, which are partly confluent, so that the wing may be said to be blackish with whitish hyaline dots; a distinct, rather broad crossband, beginning at fore border beyond the end of first vein, inclosing there two or three short hyaline streaks, crossing the middle of the first posterior cell and surrounding the hind cross vein, and ending at hind border at apex of the fifth longitudinal vein. Last sections of third and fourth veins straight and parallel.

LUZON, Tayabas, Malinao (*Baker*).

193. *Euprosopia lepidophora* sp. nov.

Similar to *E. fusifacies* Walker, from New Guinea and Aru Islands, but distinguished from it and from the other species by the elongate antennæ, which are produced to the mouth border.

Male.—Length of body, 7 millimeters; of wing, 7. Head in front with a rounded outline, about as broad as high, much broader and higher than the mesonotum; occiput black, with dense gray dust, whitish on the little-produced lower border; frons a little longer than broad, a little but distinctly narrower at vertex than in front, its broad middle stripe dark reddish, paler on the sides, with a narrow silvery border near the eyes and with scattered yellow hairs; two pairs of black vertical bristles, the inner pair only a little shorter than the external one; face flattened, much broadened below, in the form of an isosceles triangle, white, opaque, the upper angle and the base narrowly red. Antennal grooves long, diverging, yellowish white-dusted,

spotless; mouth border narrow, less prominent, with a narrow but complete blackish crossband; cheeks very narrow, linear, blackish; jowls one fifth of eye, blackish brown in front, whitish behind, and there with a very strong black genal bristle. Antennæ long, reaching the epistome, entirely red; third joint linear, very long; eight to ten times as long as the first two joints together; arista long, reddish, shortly plumose on its whole length, the feathers about as broad as the third joint. Prælabrum circular, convex, shining black; palpi broad, entirely black, with long, scattered black hairs; proboscis black.

Mesonotum short, subquadrate, black, dark gray-dusted and yellow-pubescent above; bristles long, strong, and black; pleuræ with dense pale grayish dust and long whitish hairs; on mesopleura a broad perpendicular band of whitish dust, which is continued above on the dorsum along the suture in the shape of a whitish triangle. Scutellum black, with yellow pubescence and with a spot of whitish dust on each side at apex, which is convex, not emarginate; two pairs of strong black apical bristles. Squamæ whitish; halteres yellowish. Abdomen black, gray-dusted; the last three segments provided with scattered, broad whitish scales. Venter and genitalia black. Legs deep black, with black pubescence, front coxæ gray-dusted and white-pubescent anteriorly; basal joint of all the tarsi whitish.

Wings not yellow at base, the fuscous pattern about as in Hendel's Plate II, fig. 39; a dimidiate band before the middle band; the third band prolonged to the hind border, the apex of wing appearing entirely fuscous, with two hyaline spots.

LUZON, Tayabas, Malinao (*Baker*).

194. *Euprosopia longicornis* sp. nov.

Closely allied to *E. lepidophora*, but smaller and differently colored.

Male and female.—Length of body, 5 to 5.5 millimeters; of wing, 5 to 5.5. Head exactly as in *E. lepidophora*, but the antennæ entirely black, a little dark brownish near the base; the third antennal joint longer, being a little longer than the face; the broad facial triangle more yellowish than white and destitute of red stripes; epistome without black band; the genal bristle much weaker.

Mesonotum and abdomen entirely as in *E. lepidophora*, ovipositor short, broad, flattened, black. Legs with the four posterior tibiæ broadly yellowish on the basal half; hind femora with long and dense whitish hairs below.

Wings as in *E. lepidophora*, but the pattern less dark; the

hyaline space between the second and third bands has above near the fore border a fuscous triangular spot, prolonged to the second longitudinal vein, which is entirely wanting in *lepidophora* and in *fusifacies*; the præapical band is likewise complete, but there is no dark spot in the hyaline hind border of the second posterior cell.

LUZON, Tayabas, Mount Banahao (*Baker*).

195. *Tæniaptera nigripes* van der Wulp. 1881.

Los Baños, Mount Maquiling, Luzon. Philippine specimens like the present ones have been referred by Osten Sacken to this species described from Sumatra, but I think it probable that they belong to an undescribed species; the rings on femora are white, not reddish as in typical specimens.

196. *Eurybata hexapla* O. S. 1882.

Luzon, Laguna, Los Baños and Mount Maquiling. A very strange and beautiful endemic insect.

Telostylus niger Bezzi, 1913.—This species, described in the first century,¹⁰ seems to be common in the Islands, being also represented from Mount Maquiling; Professor Baker has reared it from fallen fruits of *Terminalia nitens* Presl.

Male.—The undescribed male is like the female, but is noticeably different in the front legs like the males of other species of the genus *Telostylus*. The front femora are provided below on the apical half with two rows of short black spines, those of the internal rows being distinctly longer. The basal joint of each front tarsus is considerably swollen and spindle-shaped. The femora of all the legs, and chiefly those of the intermediate pair, are distinctly thickened. The genitalia are prolonged as a cylindric protuberance, which is bent below, and in front of this there is another yellow prominence.

197. *Nothybus triguttatus* sp. nov.

Very like the typical species, *N. longithorax* Rondani, from Borneo, but differing in the wing pattern.

Male.—Length of body, 7 millimeters; of wing, 7. Head yellow. Occiput very much hollowed above, the eyes being prominent on the sides; frons with a deep and broad excavation at vertex behind the ocelli, and there with a striking velvety black subquadrate spot; the remainder of frons gently convex, strongly glistening, with a broad velvety black spot on each side, in contact with the eyes and of triangular shape, prolonged behind

¹⁰ This Journal, Sec. D (1913), 3, 329, No. 85.

along the orbits to their middle and in front entirely to cover the narrow cheeks. Face elongate, narrower than the frons, yellow above, whitish below and there with a prominent, oval, strongly glistening blackish brown tubercle, the surrounding area shining white; prælabrum prominent, triangular, whitish; palpi whitish, narrow, almost bare; proboscis yellowish. Antennæ short, inserted above the middle of eyes, the two basal joints yellow, with some black hairs and a longer bristle above at end of the second; third joint rather acute at end, not longer than the first two joints together, deep black with narrowly yellow base; arista blackish, incrassate at base, very long-plumose to the end. Cephalic bristles strong and black; two pairs of verticals, bent backward, the inner pair longer and placed more forward; two pairs of fronto-orbitals, likewise bent backward, of equal size, one at level of the ocelli, the other before the middle of the frons; no distinct ocellar or postvertical bristles. In profile view the head is almost entirely occupied by the eyes, which are rounded and of great size; frons only a little prominent above the antennæ; ocelli placed just at middle distance between the inner vertical and the anterior fronto-orbital bristles.

Mesonotum entirely yellow, a little shining and a little darker on dorsum, more orange and opaque on sides and on pleuræ; conical and exceedingly prolonged in front; on dorsum clothed by short black hairs disposed in almost regular longitudinal rows; quite bare on pleuræ. Bristles black; no humeral; a single notopleural, the posterior one, placed apparently on the pleura, on account of the peculiar form of mesonotum, and just below the very oblique and broadly interrupted suture; one anterior and one posterior supra-alar; one pair of dorsocentrals very near the scutellum; one mesopleural. Scutellum elongate, triangular, with one basal and one apical pair of long bristles; postscutellum of a very peculiar form, in shape of an obtuse cone, more prominent than the scutellum itself, entirely yellow, opaque; mesophragma short, yellow, whitish-dusted. Squamæ very small, yellowish, with brown border; halteres yellowish, with brown knob.

Abdomen narrower than the thorax, elongate, linear, of equal breadth throughout; about as long as the mesonotum, entirely yellow, opaque, with short black hairs; the last segment whitish-dusted; the very small genitalia yellow, whitish-dusted, retracted, destitute of appendages. Venter pale yellow, with black hairs on the sides. Legs thin, not elongate; coxæ and femora yellow; tibiæ and tarsi black, but on these last the elongate prætarsi of the front pair whitish; front coxæ with some short black hairs

at end; middle coxæ with a long bristle on the middle of anterior side; apical spur of middle tibiæ very long, black.

Wings spatulate, constricted to form a long and narrow basal stalk; uniformly suffused with a pale yellowish tinge and with the apical third infuscated; the internal limit of this infuscation marked by a narrow, oblique brown band, which begins at fore border a little before the end of the marginal cell and, passing over the hind cross vein, ends at the fifth longitudinal vein. In this fuscous apical part are three distinct, oval, subhyaline spots, one in the submarginal, one in the first posterior, and one in the second posterior cell. Veins yellowish; the first longitudinal very short, ending at end of the stalked part of the wing; second very long, ending before the apex symmetrically with the fourth; while the third ends at the apex itself; these three veins are perfectly straight, placed at equal distances, and slightly diverging toward the end. Discoidal cell very long, the anterior cross vein placed before its middle; second basal cell a little shorter than the anal cell; the basal section of the fourth interrupted before its end; anal cell rather acute on the lower angle, its terminal vein being oblique; last section of the fifth longitudinal vein much shorter than the perfectly straight and perpendicular hind cross vein.

MINDANAO, Butuan (*Baker*).

198. *Stylogaster bakeri* sp. nov.

This new species is a very important addition to the oriental fauna, being the first species of this genus known from the Orient. It is named in honor of Professor Baker. It seems to be allied to the recently described *S. frontalis* Kröber, 1914, from Belgian Congo; but it is distinct from that and from any other at present known by the peculiar brush of hairs at the base of the hind femora in the male.

Male and female.—Length of body (without antennæ and without ovipositor), 6.5 to 7.5 millimeters; of wings, 6 to 6.5. Head broader than the thorax, of almost circular outline in front view; occiput flat, a little hollowed above behind the vertex, black, densely gray-dusted, with few whitish hairs and a row of short, bristly white hairs at some distance from the eye border. Eyes reddish brown, about two and a half times higher than broad in profile, with the central interior areolets much dilated; frons much narrower than an eye, a little narrowed from vertex to antennæ, pale yellowish opaque, with a very broad shining black ocellar plate, which with its obtuse fore angle is in contact with the lunula, leaving free only a narrow line on sides at

the vertex; ocelli placed near the base of this plate, but a little removed from the vertical keel; in the female the frons is distinctly narrower than in the male and entirely occupied by the shining black plate. Face pale yellowish, white-shining, much narrower than the frons, strongly raised toward the middle, in the shape of a longitudinal keel, entirely bare; jowls rather prominent, colored like the face; mouth opening triangular; chin short, with whitish hairs. Proboscis thin, much longer than body when exerted, black, with narrowly yellow base and broadly yellow end of lips; no distinct palpi; antennæ porrect, first joint very short, whitish, bare; second joint reddish yellow, longer than the first, produced in a lobe on inner side of the third, with short black hairs; third joint reddish yellow, darkened along the upper border, about as long as the first two joints together, broad, obtuse at end with a rather thick, subapical, bare black arista, the two basal joints of which are small but distinct. Of cephalic bristles there is only one pair of strong, long, black, parallel or slightly converging, inner verticals; the sides of frons near the base have two or three short, bristly black hairs directed forward; the rest of the frons is quite bare like the ocellar plate.

Mesonotum subquadrate, as long as broad, strongly convex, dark yellowish, red, or black, with two approximate, longitudinal brown stripes which are prolonged behind a little over the middle and with two broader but less distinct stripes on sides not prolonged over the suture in front; pleuræ and breast pale yellowish, almost whitish; humeral calli rounded, very prominent, pale yellowish. Dorsum clothed with short and scanty black hairs; bristles black, long, and strong; three posterior notopleurals, approximate; three to five supra-alars; one dorsocentral near the scutellum; one very long and strong pteropleural. Scutellum small, convex, rounded, reddish brown above, yellowish on sides and below, with one apical pair of long, diverging black bristles. Postscutellum convex, prominent, dark brownish in the middle; mesophragma narrow, yellowish. Squamæ yellowish, with black border; halteres yellowish. Abdomen elongate, with parallel sides, a little narrower than, and about three times as long as, the thorax; entirely reddish yellow, rather shining, the hind borders of segments two to five with a blackish transverse band above, which is not prolonged to the sides. Second segment on sides with five or six long, bristly black hairs, the rest with short black hairs; venter pale yellow. Male genitalia subglobose, yellow, with two brown spots above near the base, shining yellow below and with some short black ap-

pendages; in middle there are two long pale yellowish cerci with short black hairs; the last abdominal sternite is in the shape of a prominent, obtuse pale yellowish point, directed forward. Ovipositor as long as the abdomen, strongly compressed, with the first segment yellow, the second black.

Legs long, the four anterior tarsi longer than their tibiae; hind legs distinctly stronger than the others, with rather thickened femora; the four front pairs and their coxae entirely pale yellowish, with the last three tarsal joints blackish; coxae with some short and pale yellowish hairs. Hind legs with swollen reddish brown coxae; femora yellowish, with a more or less broad brown ring near the middle; tibiae and tarsi black, the tibiae with a broad whitish ring below the middle. In the male the hind femora have on the inner side near the base a conspicuous brush formed by some rows of rather long black hairs, the ends of which are curved below.

Wings dark grayish hyaline, strongly iridescent with black veins. Venation normal; the first posterior cell rather broad, the bend of the fourth longitudinal vein being rounded but strong.

LUZON, Laguna, Mount Maquiling (*Baker*).

199. *Hippobosca equina* Linn. 1758.

LUZON, Rizal, Alabang (*Mitzmain*). This is the first time that this common insect is recorded from the extreme Orient; it has been imported into Australia and into some of the Polynesian Islands. Probably a recent introduction in the Philippines.

200. *Hippobosca maculata* Leach. 1817.

LUZON, Rizal, Alabang (*Mitzmain*). This species is common in India and Ceylon and is probably spread over the entire Oriental Region.

ILLUSTRATIONS

PLATE I

- FIG. 1. Head of *Schizella furcicornis* g. et sp. nov., from above. $\times 27$.
2. Wing of *Tylopterna monstrosum* g. et sp. nov.; *a*, the spine of the underside. About $\times 23$.

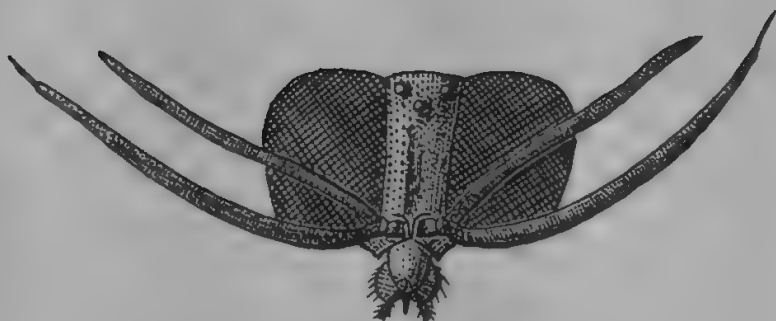


Fig. 1. Head of *Schizella furoicornis* g. et sp. nov., from above. $\times 27$.

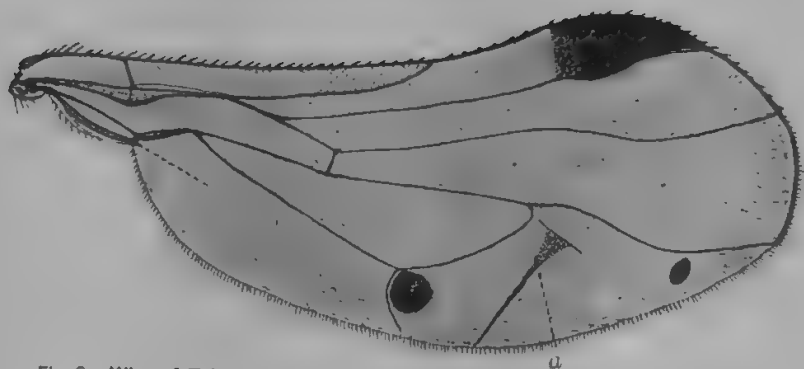


Fig. 2. Wing of *Tylopterna monstrosum* g. et sp. nov.; a, the spine of the underside. About $\times 23$.

PHILIPPINE AND ASIATIC PSYLLIDÆ

By D. L. CRAWFORD

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ONE PLATE

Since my last paper on Psyllidæ of the Orient¹ was written, several small collections have been received from Professor C. F. Baker, that most indefatigable collector. Another collection of considerable interest, from the Pusa Research Institute, includes specimens from various parts of India and Ceylon, accumulated by Mr. T. B. Fletcher. In the former collection are two new genera and several very interesting new species. In the latter collection there is only one new species, but the collection is a valuable one in that new distribution records are established for known species.

Pauropsylla brevicephala sp. nov. Plate I, fig. 11.

Length of body, 1.3 millimeters; length of forewing, 2.0; width, 0.9; width of head, 0.65. General color brown with orange or yellow markings on dorsum and pleurum of thorax; antennæ mostly light brown, apex black; wings hyaline with five black marginal spots, one at end of each of four furcal veins and of radius. Body medium to small, robust. Dorsum of head and thorax shagreened.

Head not as broad as thorax, very short, much deflexed so that it appears to be situated almost beneath the prothorax. Vertex much broader than long, uniformly rounded forward and downward, front ocellus beneath. Genæ scarcely swollen; labrum not very large. Antennæ very short, not as long as width of vertex between eyes.

Thorax strongly arched, broad. Legs short. Wings a little more than twice as long as broad, hyaline and very slightly fumate, rounded at apex, venation somewhat resembling that of *Paurocephala psyloptera*.

Abdomen short. Female genital segment small, short; dorsal valve with a rounded hirsute hump midway dorsad and the apex acute and curved upward; ventral valve very small and its apex turned downward.

MINDANAO, Davao (*Baker*), 2 females.

¹ *This Journal*, Sec. D (1915), 10, 257-269.

Homotoma bilineata sp. nov. Plate I, fig. 1.

Length of body, 2.3 millimeters; length of forewing, 2.9; width, 1.2; width of head, 0.67. General color black; forewings hyaline with two prominent black stripes joined at base and diverging in a V-shape.

Head short, as broad as thorax, deeply cleft in front, with eyes large and prominent; vertex about twice as broad as long, shining black and sparsely hairy; genæ very slightly swollen, but not wholly covering frons; antennæ not quite as long as body without wings, nearly four times as long as width of head, very thick and conspicuously hairy, with several very finely serrated carinæ on each segment; two basal segments large and thick.

Thorax not arched, relatively narrow and not robust, sparsely covered with long hairs. Legs moderately thick, but not very long. Forewings rhomboidal in shape, about two and a half times as long as broad, hyaline, with a black spot in clavus and a black stripe beginning at base of basal vein, dividing at junction point of cubitus and media into two stripes and the two extending and diverging toward apex of wing.

Abdomen long and slender. Male genital segment relatively small; forceps arched, about as long as anal valve, broadest subapically, and rounded at tip, somewhat hairy.

LUZON, Laguna, Mount Maquilung (*Baker*), 1 male.

In general aspects this species resembles *Homotoma pacifica* Crawford; but in the shorter antennæ, in wing shape, and in wing markings it is quite distinct.

Genus *CARSIDAROIDA* novum

Head much less deeply cleft in front than in *Carsidara*; vertex large, more or less quadrate, flattened; genæ covering frons and meeting vertex above antennal bases, with anterior ocellus at junction point and appearing to be in middle of vertex because of obscurity of suture between vertex and genæ; genæ swollen beneath antennal sockets, but without genal cones. Antennæ long and slender. Labium very long and slender and prominent.

Thorax not much arched, broad; pronotum long. Legs long and large; hind tibiæ with a spur at base and spines at apex. Forewings long, venation similar to that of species of *Carsidara*; with a callus (pseudovein) connecting medial and radial veins as in *Tenaphalara* and in *Carsidara*.

Type of genus: *Carsidaroida heterocephala* sp. nov.

Although this species differs from species of *Carsidara* in having the head less cleft in front, yet the position of the anterior

ocellus, the shape and the venation of the wing, the armed hind legs, the long labium, and the swollen genæ all point to a close affinity with the subfamily Carsidarinae and, especially, with the genus *Carsidara*.

Carsidaroida heterocephala sp. nov. Plate I, fig. 7.

Length of body, 2.6 millimeters; length of forewing, 4.8; width, 1.7; width of head, 0.8. General color brownish; thorax with alternating orange and brown or blackish stripes; head light brown or with a yellowish tinge; eyes black; abdomen darker than thorax. Body large.

Head not as broad as thorax, scarcely deflexed; vertex relatively small, more than half as long as broad, with a conspicuously raised margin extending between vertex and each eye and along posterior margin, but the posterior ocelli outside of this elevated rim; within the rim the vertex is rather flat, presenting the appearance of a saucer with perpendicular sides; front ocellus situated a little anterior of the center of this saucer, at obscure junction point of vertex and genæ. Genæ produced in front into a pair of very large, diverging, antennal sockets to the ends of which the antennæ attach, without genal cones except two exceedingly small ones far back under head just in front of labrum; antennal-socket enlargements of genæ very large and prominent beneath head, extending back toward labrum as a pair of parallel half-cylinders. Antennæ not quite as long as body without wings, nearly four times as long as width of head with eyes, slender, black at tip. Eyes relatively large. Labium very long.

Thorax large, not strongly arched; pronotum with a small epiphysis in front at center; legs long, rather large; hind tibiæ with a large spur at base and five large black spines at apex, one larger than the other four; other tibiæ with a fine comb of slender spines at apex. Forewings long, about three times as long as broad, hyaline with a faint smoky tinge, with several brown or black spots scattered about in apical portion; pterostigma rather large; with a callus (pseudovein) connecting radius and media and another connecting the radius and pterostigmal vein.

Abdomen very long and slender, tapering gradually to genital segment. Male genital segment rather small; anal valve with a broad, apically rounded erect portion and a horizontal prolongation, triangular in shape, reaching backward; forceps as long as anal valve, curved inward and forward, broadly rounded at apex; with a second and smaller pair of forceps cephalad of principal

pair. Female genital segment about one third as long as rest of abdomen, acutely pointed at apex, dorsal valve a little longer than ventral.

LUZON, Benguet, Baguio (*Baker*), 1 male and 1 female.

Rhinopsylla distincta sp. nov. Plate I, fig. 6.

Length of body, 2.9 millimeters; length of forewing, 4.8; width, 1.8; width of head, 0.7. General color light reddish brown to brown; eyes dark; parts of dorsum reddish; antennæ brown.

Head nearly as broad as thorax, scarcely deflexed, deeply cleft in front, covered sparsely with long hairs; posterior ocelli conspicuously elevated. Genæ swollen beneath into a pair of blunt processes (genal cones) projecting vertically downward and situated far back under the head near labrum. In some of the other species of this genus the genæ are swollen, but not into conical processes as in this species. Antennæ very slender, four times as long as width of head, large at base.

Thorax not broad, scarcely arched; pronotum short and much depressed below level of head and mesonotum; legs long, rather slender, hairy; hind tibiæ with a spur at base. Forewings very long, reaching more than half their length beyond abdomen, hyaline, acute at apex; first marginal cell larger than second.

Abdomen slender, rather small. Female genital segment about as long as rest of abdomen, both valves tapering to an acute end, the dorsal valve a little longer than ventral, sparsely hairy.

LUZON, Benguet, Baguio (*Baker*), 1 female.

Genus STROGYLOCEPHALA novum

Head short, not deflexed, very uniformly rounded in front, the eyes and vertex together forming almost a hemisphere; ocelli not elevated; frons not wholly covered by genæ, visible as a small sclerite between genæ with front ocellus at its apex; genæ not swollen into cones; labrum small; labium short. Antennæ short, a little longer than width of head. Thorax not arched; pronotum relatively long and with præscutum forming somewhat of a "neck." Legs short and not large. Forewings slender, acute at apex, with pterostigma.

Type of genus: *Strogylocephala fascipennis* sp. nov.

This genus is a member of the subfamily Pauropsyllinæ resembling *Pauropsylla* in some head characters, as the visible frons and rounded vertex, but differing from most others of this subfamily in the unarched thorax and slender wings. In the latter characters there is some resemblance to the Carsidarinae. The aspect of the type species is suggestive of *Tenaphalara*.

Stroglylocephala fascipennis sp. nov. Plate 1, fig. 12.

Length of body, 1.3 millimeters; length of forewing, 1.8; width, 0.55; width of head, 0.4. General color dark brown or reddish; abdomen light brown; legs and antennæ yellow, the latter black at tip; wings with a brown band along posterior margin. Body small, slender.

Head almost hemispherical, not deflexed; vertex roundly convex, without depressions, finely punctate, posterior ocelli not elevated. Frons a narrow sclerite about one half to one third as broad as long. Genæ not at all swollen, except at attachment of antennæ and there only a little swollen, covering basal portion of frons. Antennæ about one half longer than width of head, slender, with rather long, terminal setæ.

Thorax scarcely elevated, not broad. Legs short, not armed. Forewings nearly three times as long as broad, very slender, acutely pointed, with first marginal cell very small; a broken and irregular brown band extends along posterior margin from base to apex, usually with a break about midway.

Abdomen slender. Male genital segment small; forceps short, small, almost as long as anal valve, inner surface toothed, pointed at apex, outer surface arcuate; anal valve small, erect, simple. Female genital segment small and short; dorsal valve rounded apically with a sharp, pointed prolongation at end; ventral valve shorter, more acute at apex.

LUZON, Laguna, Los Baños (*Baker*), 2 males and 1 female.

Epipsylla forcipata sp. nov. Plate I, fig. 2.

Length of body, 2.8 millimeters; length of forewing, 3.4; width, 1.3; width of head, 0.84. General color light orange to lemon yellow; eyes and tips of antennæ black. Body a little larger than that of *Epipsylla pulchra* and lighter colored, without the conspicuous notal stripes of the latter.

Head not quite as broad as thorax, somewhat deflexed; vertex about three fourths as long as broad between eyes, with two large, shallow depressions between ocelli; front ocellus visible from above. Genal cones very long and slender, about one third longer than vertex, very little or not at all divergent, subacute. Antennæ about as long as body without wings, seldom longer, slender.

Thorax not strongly arched, broad; pronotum long, flat. Hind tibiae with small spur at base and four back spines at apex. Wings hyaline, with an orange tinge, acutely rounded at apex, about two and one-half times as long as broad, pterostigma present.

Abdomen moderately long, not large. Male anal valve a little broader than forceps, truncate at apex with a slender prolongation reaching upward and backward toward forceps. Forceps as long as anal valve, stout, arched, with a row of about six black spines at apex and about six or seven on inner surface near apex pointing backward and interlocking with the corresponding spines of the opposite side; these are apparently a great aid in holding the female genital segment during copulation. Female genital segment nearly as long as the remainder of abdomen, tapering to the subacute apex; dorsal valve a little longer than ventral.

PALAWAN, Puerto Princesa (*Baker*), 3 males and 5 females.

Epipsylla pulchra Crawford.²

The female genital segment, not described in the original description of the species, is very similar to that of *E. forcipata*.

LUZON, Benguet, Baguio (*Baker*), 3 males and 2 females.

Euphalerus citri (Kuwayama).

Euphalerus citri (KUWAYAMA), CRAWFORD, Rec. Ind. Mus. (1912), 7, 424, Pl. 35, fig. D.

This is a widely distributed species throughout the Orient, from India through China to the Philippines. Additional specimens are before me now showing some slight variations from the typical forms in wing coloration—as might well be expected in such a widely distributed species—collected at Coimbatore, South India, by "T. V. R." on *Cardia*, August 4, 1913; others from the same locality on August 22, 1913, collected by "C. N." on *Cardia cardata*; others collected at Poona, Bombay, by T. B. Fletcher, Sept. 8, 1911.

Arytaina variabilis sp. nov. Plate I, fig. 3.

Length of body, 2.1 millimeters; length of forewing, 2.4; width, 1.3; width of head, 0.85. General color greenish yellow; eyes black; wings darker, with a brown apical and anterior, marginal band sometimes with darker spots scattered through the band. Body very robust, surface covered with stiff pubescence.

Head nearly or quite as broad as thorax, rather strongly deflexed. Vertex a little more than half as long as broad, surface irregular, with a transverse depression between posterior ocelli and from there roundly convex and sloping downward toward front ocellus; posterior ocelli scarcely elevated; anterior ocellus

² *This Journal*, Sec. D (1913), 8, 297.

easily visible from above. Genal cones large and broad, not divergent, rounded at apex, continuing in same plane with vertex, but separated therefrom by a deep furrow, about as long as breadth at base, with short stiff pubescence. Antennæ about as long as body without wings, very slender.

Thorax broad and robust, hairy. Legs short and stout; hind tibiæ with spur at base. Forewings broad, scarcely twice as long as broad, membrane scarcely hyaline, apex broadly rounded or a little angulate, veins setose; a darker band, often with black spots scattered through it, extends from first cubital vein around apex of wing to base of pterostigma; central portion light brown; second marginal cell differing in shape among individuals of the species.

Abdomen relatively short and thick. Male genital segment moderately large; forceps large, broad, spatulate, very broad at apex, apical margin rounded, broadly and finely toothed; anal valve longer than forceps, tapering to a small end. Female genital segment not as long as rest of abdomen, much smaller, tapering to acute end, dorsal valve a little longer than ventral.

MINDANAO, Butuan (*Baker*), 1 male; Davao (*Baker*), 1 male: LUZON, Tayabas, Malinao (*Baker*), 1 female. A fourth specimen, a female, from Mount Banahao, Laguna, Luzon (*Baker*), shows the venational characteristics of the Butuan male, but is destitute of the wing coloration present in all the other specimens. Whether this is a constant variation—a subspecies—or a chance individual not wholly developed is impossible to judge from the one specimen at hand. It appears that in this species there is a considerable variation in wing color and body color and in minor venational characters.

Arytaina tuberculata sp. nov. Plate I, fig. 8.

Length of body, 3.8 millimeters; length of forewing, 3.5; width, 1.8; width of head, 1.0. General color orange to tawny brown; eyes black; abdomen dark brown; antennæ dark over apical half; wings brownish. Body large, robust, surface covered with short, stiff pubescence.

Head nearly as broad as thorax, large, strongly deflexed. Vertex large, about half as long as breadth between eyes, each half roughly triangular in shape with the two discal depressions meeting at midline and forming one larger cavity, with a prominent wartlike tubercle on each side between posterior ocellus and antennal base; posterior ocelli elevated; anterior ocellus in notched front margin of vertex. Genal cones large, as long

as or slightly longer than basal width, extending forward in same plane with vertex, but separated therefrom by a deep furrow; broadly rounded at apex, a little divergent, hairy. Antennæ nearly as long as body without wings.

Thorax broad and large, strongly arched, hairy. Pronotum long. Legs large and stout; hind tibiae with a prominent spur at base and the apical spines large. Forewings broad, about half as wide as long, light brownish and partially transparent, rounded broadly at apex; veins not setigerous.

Abdomen large, short. Female genital segment not as long as rest of abdomen, much smaller, acute at apex, dorsal valve a little longer than ventral.

MINDANAO, Davao (*Baker*), 1 female.

Arytaina punctipennis Crawford.

Psyllopa punctipennis CRAWFORD, Rec. Ind. Mus. (1912), 7, 431. Pl. 34, figs. K, O, Pl. 35, fig. U.

This interesting species was described originally as a *Psyllopa*, but this genus has subsequently been merged by the author with the older genus *Arytaina*. This species is a pest of indigo in the Orient and probably is the same as Buckton's *Psylla isitis*, but this identity has not been fully established. Several specimens are before me from Peradeniya, Ceylon, collected by T. B. Fletcher on *Indigofera*, April 14-17, 1914.

Psylla colorada sp. nov. Plate I, fig. 13.

Length of body, 1.6 millimeters; length of forewing, 2.1; width, 0.87; width of head, 0.55. General color bright red throughout, except antennal tips and eyes brown or black.

Head about as broad as thorax, well deflexed. Vertex about half as long as broad; posterior ocelli elevated on small pedicels; genal cones a little longer than vertex, strongly divergent, narrowly rounded at apex, sparsely clothed with long hairs. Antennæ scarcely two and one-half times as long as width of head, slender.

Thorax strongly arched. Legs small. Forewings hyaline, veins reddish, membrane uncolored; pterostigma rather large. Abdomen short. Male genital segment short, small; forceps spatulate, truncate, somewhat toothed at apex, arched; anal valve a little longer than forceps, long and narrow in profile, tapering to apex.

LUZON, Laguna, Mount Maquiling (*Baker*), 5 males.

This species resembles somewhat *Psylla coccinea* Kuwayama,

of Japan, but differs in head characters of some importance as well as in coloration, although both species are bright red in general color.

Psylla crenata sp. nov. Plate I, fig. 9.

Length of body, 3.0 millimeters; length of forewing, 3.6; width, 1.5; width of head, 1.1. General color dark brown, with light brown patches on vertex and both thoracic and abdominal dorsum; wings with yellowish tinge and a prominent dark band on apical margin. Body large and very robust.

Head large and broad, but not quite as broad as thorax, strongly deflexed. Vertex about half as long as broad, each half strongly triangular, converging toward front ocellus, posterior ocelli large and somewhat elevated; between each posterior ocellus and antennal base is a wartlike prominence. Genæ very large, prominent around antennal bases and conspicuous between vertex and eyes; genal cones large, as long as vertex, a little divergent, subacute at apex, pubescent. Antennæ very long and slender, fully as long as entire body to tip of wings or about four times as long as width of head.

Thorax very broad and large, strongly arched; pronotum sinuate or crenate on dorsal surface, with three rounded convexities. Legs large, hairy; hind tibiæ with a prominent spur at base. Forewings large, broad, broadly rounded at apex, with a broad brown or black band with indefinite margin extending around apex of wing from tip of claval suture to middle of radial cell; membrane of wing fumate or light brown.

Abdomen very large. Female genital segment large, as long as or longer than rest of abdomen, converging to acute apex, dorsal valve longer than ventral.

MINDANAO, Butuan (*Baker*), 1 female.

Trioza eugenioides sp. nov.

Length of body, 1.9 millimeters; length of forewing, 3.8; width, 1.4; width of head, 0.7. General color brown to dark brown, with lighter tawny stripes along dorsum and patches of the same color on pleura and abdomen.

MINDANAO, Butuan (*Baker*), 3 females; no data on food habits given.

The general appearance and structure are similar to *Trioza eugeniæ* Crawford^a and *Trioza asiatica* Crawford,^a but the

^a *This Journal*, Sec. D (1915), 10, 265, Pl. I, fig. e, 266.

species differs from both in color, wing venation, and a few other characters. These differences may be summarized as follows:

1. Thorax smooth, shining, black; wings very narrow, about three times as long as broad; second marginal cell about twice as long as greatest width; fourth furcal ($M_1 + 2$) terminating in wing apex; male anal valve almost quadrate; genal cones about one third as long as vertex.

Trioza asiatica Crawford.

2. Thorax punctate or rugulose, not smooth; light green or yellowish green; wings about three times as long as broad; second marginal cell about two and one-half times as long as greatest width; fourth furcal ($M_1 + 2$), extending to apex or near it. Male anal valve triangular. Genal cones half as long as vertex.

Trioza eugeniae Crawford.

3. Thorax punctate and brown with light stripes and blotches; wings about two and three-fourths times as long as broad; second marginal cell only a little longer than greatest width; fourth furcal ($M_1 + 2$) terminating in front of apex with apex within second marginal cell. Genal cones strongly decurrent, fully one half as long as vertex or more.

Trioza eugenioides sp. nov.

All three of these species are probably gall-forming, as mentioned in the paper cited in the footnote. One very large female in the collection, from Mount Banahao, Luzon (*Baker*), seems to belong to a fourth species of this group, but I am deferring its description until more specimens appear.

Trioza divisa sp. nov. Plate I, fig. 5.

Length of body, 2.1 millimeters; length of forewing, 3.7; width, 1.5; width of head, 0.8. One half black and one half light; head, thorax, base of abdomen, and legs dark brown or black; caudal half of abdomen white; basal third of wings black, remainder hyaline, the hyaline portion beginning at the white portion of abdomen, thus dividing insect into anterior dark half and posterior light half. Body robust; surface covered with long slender hairs.

Head strongly deflexed, not as broad as thorax. Vertex distinctly longer than half its width, somewhat irregularly convex, sparsely covered with long hairs, posterior ocelli not elevated. Genal cones nearly as long as vertex, extending nearly parallel to plane of vertex but below it. Eyes large. Antennae about one and one-half times as long as width of head, whitish except black at tip, with several very long hairs on each segment.

Thorax robust, broad, large, arched; pronotum short and depressed. Legs hairy, rather stout; hind tibiae with small spur at base and three thick spines at apex. Forewings about two and

one-half times as long as broad, black and opaque on basal third, hyaline or slightly fumate on remainder; veins with very long hairs; with a tendency toward a cubital petiole, but otherwise not related to *Ceropsylla*.

Abdomen (of male) very short. Male genital segment small and whitish or yellow; anal valve small, hood-shaped, profile narrow and longer than forceps, subacute at apex; forceps relatively broad, arched, apex truncate.

LUZON, Benguet, Baguio (*Baker*), 2 males.

Trioza luzonensis sp. nov. Plate I, fig. 10.

Length of body, 2.3 millimeters; length of forewing, 3.2; width, 1.3; width of head, 0.75. General color light orange to reddish or to yellowish; apical third of antennæ black. Body surface sparsely hairy.

Head not much deflexed; vertex fully half as long as broad, with a prominent elevation at each posterior ocellus and a prominent convexity on each side of median line, with a deep sulcus between each ocellus and medial convexity. Genal cones small, scarcely half as long as vertex, divergent, rounded or subacute, well below plane of vertex. Antennæ a little more than twice as long as width of head.

Thorax well arched. Legs somewhat hairy. Forewings hyaline, with setigerous veins. Male genital segment moderately large; anal valve large, triangular in profile, with posterior angle acute; forceps about as long as anal valve, slender, arched, acute at apex. Female genital segment less than half as long as rest of abdomen, both valves acute and about equal in length.

LUZON, Laguna, Mount Maquilang (*Baker*), 1 male and 4 females; Benguet, Baguio (*Baker*), 1 male.

Trioza fletcheri Crawford.

Trioza fletcheri CRAWFORD, Rec. Ind. Mus. (1912), 7, 434, Pl. 34, fig. V, Pl. 35, fig. Q.

Two imperfect specimens from Coimbatore, South India, seem to belong to this species, though it is impossible to make any conclusive statement because of the poor condition of the specimens. They were collected by "Y. R." in galls of *Trewia* sp., December 9, 1913.

Trioza jambolanæ sp. nov. Plate I, fig. 4.

Length of body, 2.0 millimeters; length of forewing, 3.5; width, 1.4; width of head, 0.8. General color reddish brown, abdomen

darker; antennæ and legs a little lighter brown; antennæ black at tip.

Head not quite as broad as thorax, deflexed. Vertex about half as long as broad, with a deep furrow down median line and a convexity on each side and a deep furrow on each side of these convexities and the much elevated posterior ocelli. Genal cones as long as vertex, divergent, somewhat decurrent, hairy, sub-acute. Antennæ about one and one-half times as long as width of head, slender.

Thorax well arched, broad; pronotum short, depressed. Forewings about two and one-half times as long as broad, hyaline, with a black spot in middle of clavus, rather acute at apex.

Abdomen large. Female genital segment very short, dorsal valve longer than ventral, both acute.

BENGAL, Pusa (C. S. Misra), 2 females, on *Eugenia jambolana*, Feb. 3, 1915.

Type specimen deposited in British Museum, London.

ILLUSTRATIONS

PLATE I. FOREWINGS OF NEW PSYLLIDÆ

- FIG. 1. *Homotoma bilineata* sp. nov.
2. *Epipsylla forcipata* sp. nov.
3. *Arytaina variabilis* sp. nov.
4. *Trioza jambolanæ* sp. nov.
5. *Trioza divisa* sp. nov.
6. *Rhinopsylla distincta* sp. nov.
7. *Carsidaroida heterocephala* g. et sp. nov.
8. *Arytaina tuberculata* sp. nov.
9. *Psylla crenata* sp. nov.
10. *Trioza luzonensis* sp. nov.
11. *Pauropsylla brevicephala* sp. nov.
12. *Stroglylocephala fascipennis* g. et sp. nov.
13. *Psylla colorada* sp. nov.

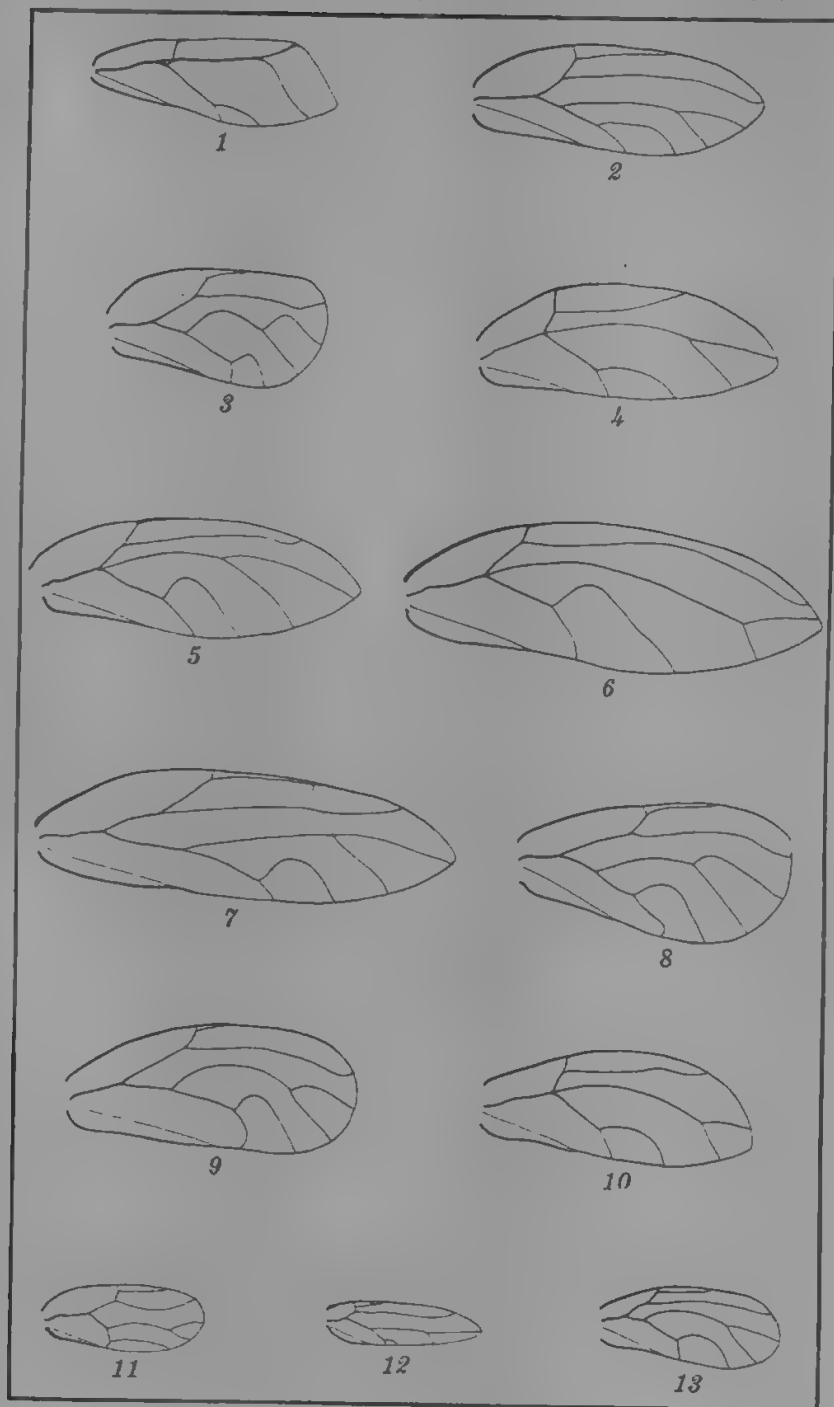


PLATE I. FOREWINGS OF NEW PSYLLIDÆ.

THE MOSQUITO FISH, *GAMBUSIA AFFINIS* (BAIRD AND GIRARD), IN THE PHILIPPINE ISLANDS

By ALVIN SEALE

(From the Section of Fisheries, Biological Laboratory,
Bureau of Science, Manila)

ONE TEXT FIGURE

In 1905 I was commissioned by the Hawaiian Government to secure and transport to the Hawaiian Islands a shipment of fish that would live in areas infested by mosquitoes and feed on the larvæ and eggs of these pests.

At that time practically nothing was known regarding any species that might fill these requirements, nor was it known if such a fish, when found, could be successfully transported a great distance. Helpful suggestions were received from various friends, and I proceeded to Seabrook, Texas, to look for the desired fishes.

At that place I noticed a number of small top-minnows, or killifishes, feeding on mosquito larvæ. An examination was made of the stomach contents of several species in order to ascertain which had eaten the greatest number of mosquitoes. This resulted in *Gambusia affinis* being selected, and there has been no reason to regret the choice. This species is now known throughout the Orient as the "mosquito fish."

About 400 specimens of this species were transported in ordinary 10-gallon milk cans and landed at Honolulu September 15, 1905. When the fish were liberated in small breeding ponds, which were stocked with mosquito larvæ, they at once made a vigorous attack upon these pests, suggesting a pack of wolves ravaging a flock of helpless sheep.

Two years later Dr. D. L. Van Dine, entomologist for the Hawaiian Government, wrote as follows regarding these fish:¹

They have multiplied rapidly and from the few hundred introduced, several hundred thousand have been bred and distributed. Where they occur they effectively clear the water of mosquito larvæ, feeding likewise on the eggmasses of *Culex pipiens* on the surface.

At the present time (1916) there are millions of these fish in the Hawaiian Islands, and two men of the health department

¹ Press Bull. Hawaii Agr. Exp. Sta. (1907), No. 20, 10.

are kept busy distributing them to various parts of the Islands. The decrease in the number of mosquitoes is very noticeable, and the Governor of the Islands writes:

The top-minnows have been a decided success. Where ponds have swarmed with larvæ of mosquitoes, the top-minnows have entirely cleaned them out in a few days.

Letters from other persons in the Islands have been to the same effect.

When returning to the Philippine Islands from the United States in 1913 I secured two dozen mosquito fish at Honolulu, placed them in a glass jar in my stateroom, and brought them to Manila. The offspring of these fish now number many thousands and are being widely distributed throughout the Philippine Islands and the Orient, as will be seen in the following report.²

DESCRIPTION OF THE MOSQUITO FISH

The mosquito fish, *Gambusia affinis* (Baird and Girard), is very small. The female when full-grown is about 5 centimeters (2 inches) in length; the male is smaller. The general color is light olive, with the belly silvery. The female has a distinct blackish spot on each side of the belly. There is one small fin on the back (dorsal) which has seven rays, three fins on the belly (ventrals and anal), and one fin on each side (pectorals).

In this species the sex is easily distinguished by the shape of the anal fin; in the male this fin is long and slender and the anterior rays are modified to form an intromittent organ. In the female the anal fin is large and normal in shape, with ten rays. The mouth is small. The eye is large. These fish usually swim near the top of the water. It seems to matter very little whether the water is fresh or brackish, clear or muddy, warm or cold. They thrive in all sorts of places.

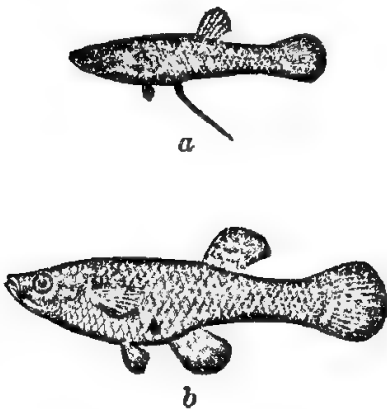


FIG. 1. Top minnow, or mosquito fish, *Gambusia affinis* Baird and Girard; a, male; b, female. About actual size.

² An additional shipment of mosquito fish was ordered from Honolulu, but the fish received proved to be *Melanesia latipinnis*, and so were not liberated.

BIRTH OF THE YOUNG FISH

The mosquito fish does not lay eggs, but gives birth to fully formed and very active young. The exact procedure of each parent in this important function is given below, being described from observations of the actions of a half-grown female mosquito fish, length, 34 millimeters, and of a young male, length, 23 millimeters, which were placed in a small glass jar on my study table where they could be observed perfectly. Observations began December 8, 1915.

As soon as the male saw the female, he became greatly excited, as was indicated in the swift change of color to a beautiful opalescent blue on the head and the sides. He at once made swift dashes at the female, and acted as if he intended to bite her on the lower abdomen. He made no attempt to copulate with her. The female strongly resented these actions and tried to escape. The male continued the swift dashes and attacks upon the female for ten minutes. The female finally became quiet near the bottom of the jar and gave birth instantly to a young fish, which came out head first and shot to the surface of the water, where it swam about vigorously.

The male fish in the meantime had become perfectly quiet, resting about 2 centimeters directly behind the female. His great interest and excitement, however, were well shown in the rapid working of his gills, the quick vibration of his caudal fin, and the beautiful play of iridescent blue over his body.

As soon as the young fish was born the female swam away, but she was again vigorously and continuously attacked by the male until she again became quiet and gave birth to another fish. This one appeared tail first and was delivered with great difficulty. The operation lasted eight minutes. During this time the female left her position repeatedly, but each time was driven back by the male, who exhibited the most intense excitement, except when the female became quiet and attended strictly to her business, at which time he also became quiet and refrained from any attack upon her.

This female gave birth to 21 young fish, all but 2 coming into the world head first, which may be assumed as their normal manner of birth. The time consumed in the entire operation was twenty-five minutes.

Within one hour after the young were born, the mother made a fierce attack upon her offspring and succeeded in catching and eating two. These were hard to catch, and I believe that in

an unconfined space they could almost always escape. The male took no part in this cannibalistic feast.

The female was then removed to a separate jar, and the male was left alone with the young for twenty-four hours without food. He showed absolutely no disposition to attack or eat the young, although he must have been very hungry.

In old females the young shoot out without difficulty, and I have seen them give birth to five young in as many seconds. The first instinct of the young fish is to get away from the vicinity of its parents, but after swimming about for a few minutes, it settles upon the bottom or upon the leaves of the pond weeds to rest.

COPULATION AND PERIOD OF GESTATION

The following day (December 9, 1915) this male was again placed in the jar with this female. It was at once apparent that the relation between the two had entirely changed, for the female at once attacked the male and bit him viciously and chased him about the jar. The male very evidently was afraid of her. However, this did not prevent the male from making repeated successful attempts to copulate with the female. These attempts were always made by stealth and without the consent of the female.

The exact method of copulation was as follows: The male would get behind and a little below the female; then if she was not watching he would suddenly dart forward, at the same time turning forward the large modified anal fin, which functions as an intromittent organ, and would attempt to insert this organ in the cloaca of the female, who would at once turn and fiercely attack her would-be mate. These exchanges continued irregularly for about three days and were gradually given over by the male.

Eight weeks later (February 3, 1916) this female showed decided signs of pregnancy, and three weeks later (February 25, 1916) the male was seen to be making passes at the female and biting at her lower abdomen. He seemed to have lost all fear of her, while apparently she sought only to escape. This change of attitude of the sexes seems to be an unfailing sign that the spawning time has arrived. In one hour this female gave birth to 48 young. The methods followed and the actions of the adult fish were the same as previously described for this pair of fish on December 8, 1915. This second spawning establishes the fact that the period of gestation for this species is not more than seventy-nine days. During this period this pair of fish ate 5,041 mosquito larvæ by actual count.

On April 6, 1916, forty-three days after the last spawning, this female gave birth to 49 young.

During this spawning the male fish was removed to another jar. The young fish were born without difficulty and in record time. Therefore, while it might seem that the presence of the male was essential to the spawning, it is evidently not so. This female was kept under close observation for six months, during which time she gave birth to six broods of young as follows:

TABLE I.—*Number of young and dates of six broods of mosquito fish. Total, 233 fish in less than six months.*

Brood.	Young.	Date of birth.
First	21	Dec. 8, 1915.
Second	43	Feb. 25, 1916.
Third	49	Apr. 6, 1916.
Fourth	36	Apr. 27, 1916.
Fifth	40	May 30, 1916.
Sixth	39	June 23, 1916.
Total	233	

EMBRYOLOGY

The embryology and morphology of the reproductive organs of the mosquito fish have been worked out by Kuntz,³ and a brief summary of his paper follows.

The ovary of *Gambusia affinis* is a paired tubular organ without a distinct median wall, which opens directly into the urogenital sinus. Each ovum is contained in a separate cellular follicle in which fertilization takes place and the embryo is developed. At the completion of development the ovarian follicles, which are attached to the central rachis by a slender stalk, are ruptured and the young fish are extruded directly through the urogenital aperture.

The modified anal fin of the male, which functions as an intromittent organ, is controlled by a powerful muscle, which is inserted on the proximal end of the anal fin rays and has its origin on a bony process projecting ventrally from the fourth to the last abdominal vertebra, and the modified hæmal spines of the first three caudal vertebra. The third, fourth, and fifth rays of the anal fin are enlarged, greatly elongated, curved, and bear short spines on the distal portion. The interhæmal, which articulates with the third ray, is enlarged and joins with the two anterior processes on which the muscles controlling the anal fin has its origin.

The testis, like the ovary, is a paired tubular organ. The spermatozoa are contained in the spermatophores and are probably transmitted from the male to the female in these bodies.

The formation of the blastoderm and the differentiation of the embryo take place in the manner that is quite typical for all the bony fishes.

³ Kuntz, Albert, *Bull. U. S. Bur. Fisheries* (1913), 33, 181-189.

As development advances, the ovarian follicles become highly vascular, increase in size, and fill with a transparent fluid in which the embryo is constantly bathed. This fluid is aerated by follicular circulation. The gills of the developing embryo become functional comparatively early. During the later stages of the intro-ovarian life, rythmatal breathing movements of the embryo can be observed.

The young are born in an advanced stage of development and show nearly all of the diagnostic characters of the species. They undergo no marked metamorphic changes after birth.

RATE OF GROWTH AND FEEDING HABITS OF THE MOSQUITO FISH

The young fish when born is from 3 to 5 millimeters in length, is very active, and begins to feed soon after leaving the mother.

From the brood of 21 fish, previously mentioned as born on December 8, 1915, two were selected and placed in balanced aquaria. Each of these measured 5 millimeters at the time and were 21 hours old. Ten very young mosquito larvæ were selected by means of a pipette and placed in each aquarium with the young fish. I saw one of these fish, while less than a day old, catch and eat 8 of these mosquito larvæ in less than five minutes. The next day 40 larvæ were added to each aquarium. The fish were not able to handle the adult larval mosquitoes as yet, although one fish was observed to catch a big larva by its head, the larvæ being fully as long as the fish. There was a fierce struggle in which the fish was thrown from side to side; however, it hung on and in the end succeeding in killing the larva.

A careful count was made of all the mosquito larvæ fed to each of the young fish, a net being placed over the aquaria so that should any of the mosquitoes become adult they could not escaped.

On February 8, 1916, exactly two months after their birth, the fish were carefully measured. I was able to distinguish at this time that one was a male and the other a female. The male was 20 millimeters in length, the female was only 19 millimeters. The male had gained 15 millimeters and the female but 14 millimeters during the first eight weeks of their life. During this period the male ate 886 mosquito larvæ; the female ate 825.

Two weeks later, March 22, the male was 23 millimeters in length and had eaten 1,663 mosquito larvæ. The female was 26 millimeters in length and had eaten 1,547 mosquito larvæ.

When the fish were 10 weeks old, the male was placed in the aquarium with the female. He at once copulated with her.

She seemed greatly astonished and settled to the bottom, apparently to keep the male away, but he at once chased her and copulated with her repeatedly. After three hours the male was replaced in his own aquarium.

Eighteen days later, April 8, the male died. At that time he was 4 months old, measured 25 millimeters in length, and had eaten 3,520 mosquito larvæ. The young female at that date measured 33 millimeters and had eaten 3,929 mosquito larvæ. This fish showed decided signs of pregnancy, and on April 21 she gave birth to six young, which completed the cycle and made the original female we started with a grandmother in the short period of four months and thirteen days. Thirty days is probably the normal period of gestation for this species, and it matures, sexually, in from three to five months.

An experiment was made to ascertain the comparative value of the common goldfish and the mosquito fish in mosquito destruction. A goldfish was placed in an aquarium that contained 1 liter of water and 500 mosquito larvæ, and an adult mosquito fish was placed in a similar aquarium containing the same amount of water and the same number of mosquito larvæ. At the end of twelve hours the goldfish was dead and there were still left 273 larvæ in its jar, the fish having eaten 227 larvæ. The mosquito fish was still alive and well and at the end of twenty-four hours had eaten the entire 500 larvæ and was ready for more. The chief difficulty in the use of goldfish lies in the fact that, if they can get vegetation to eat, they neglect the mosquitoes. The mosquito fish not only will not feed on vegetation, but actually prefer the mosquitoes as shown by the following experiment.

Twenty live mosquito larvæ were mixed with an equal number of larval water boatmen of about the same size as the larval mosquitoes and were fed to a pair of mosquito fish in aquarium A. All of the mosquito larvæ were eaten greedily, while none of the water boatmen were eaten until eight hours later and it was the following day before all of them had been devoured. This experiment was repeated, using the young of dragon-flies and mosquito larvæ. While the preference was not so marked in this case, it was quite evident that the mosquito larvæ were the favorite food.

EXPERIMENTS WITH MOSQUITO FISH UNDER NATURAL CONDITIONS

While the facts recorded in the previous pages may be interesting and illustrate what mosquito fish will do in aquaria, they

cannot be regarded as conclusive, as the fish might act very differently under natural conditions. Therefore the following experiments conducted in open ponds are probably of greater value.

Located near the Bureau of Science are five fresh-water ponds used for fish cultural work. They range in size from 2 by 12 to 29 by 39 meters and from 0.5 to 1 meter in depth. Grass and sedges grow along the margins.

Two hundred mosquito fish were placed in the large pond. This pond was already well stocked with adult black bass, *Micropterus salmonoides* Linnæus and also contained a number of native fishes, such as *dalag* (*Ophiocephalus striatus* Bloch) and *ayunṅin* (*Therapon argenteus* Cuvier and Valenciens). The object of the experiment was to ascertain if mosquito fish could maintain themselves and multiply in a body of water stocked with these voracious fishes.

The results have been most satisfactory, for the mosquito fish not only maintained themselves and kept the pond free from mosquitoes, but during the past two years have increased to many thousands. Two thousand five hundred mosquito fish have been taken from this pond and planted in streams and swamps in the vicinity of Manila, without making any appreciable inroad on the supply.

One of the small ponds, kept as a control without any mosquito fish, soon became infested with larvæ.

From the original stock of 24 mosquito fish, brought to Manila in 1912, the Bureau of Science has distributed over 7,610 mosquito fish in the streams and swamps of the Philippines. While the fish are as yet too few to make any appreciable difference in the number of mosquitoes, there can be but little doubt that in a few years they will materially decrease the number of these pests and greatly assist in eliminating malaria from the Islands.

SHORT REVIEWS OF THE LITERATURE ON MOSQUITO DESTRUCTION EXAMINED BY THE AUTHOR

HOWARD, LELAND OSSIAN. Notes on the mosquitoes of the United States giving some account of their structure and biology, with remarks on remedies. *Bull. U. S. Dept. Agr., Div. Ent.* new. ser. (1900), No. 25.

This publication gives an account of the structure, life histories, and distribution of the mosquitoes of the United States and Alaska. Various methods for the destruction of these pests are given. The author recommends the introduction of fishes into their breeding places.

IDEM. Mosquitoes; how they live; how they carry disease; how they are classified; how they may be destroyed. New York, McClure, Phillips & Co. (1902).

In this work Doctor Howard writes, "By far the most effective natural enemy of the mosquito larvae and pupae are fish." Among the fishes mentioned are top-minnows, sticklebacks, and sunfish. Regarding the mosquito-fish (*Gambusia affinis*) he quotes Dr. H. F. Moore, of the United States Bureau of Fisheries, as follows: "It feeds largely on vegetable matter but also on insects." Moore is undoubtedly misinformed on this subject, as I have examined hundreds of stomachs of *Gambusia affinis* and have kept individuals of this species under close observation for more than two years, but have never seen the slightest indication that they would feed on vegetation even under the starvation test. Doctor Howard also lists the western salamander (*Diemytilus*), dragon-flies, predatory aquatic insects, and tadpoles as active enemies of the mosquito.

IDEM. Remedies and preventives against mosquitoes. *Farm. Bull. U. S. Dept. Agr.* (1911), No. 444.

Gives a list of protective liquids and recommends: Oil of citronella, 1 ounce; spirits of camphor, 1 ounce; oil of cedar, $\frac{1}{2}$ ounce. This paper also gives methods of screening, smudging, and fumigating, recommending for this purpose pyrethrum powder. The irritation caused by the bite of the mosquito may be relieved by applying a cake of moist soap to the bite. In regard to the destruction of mosquito larvae by natural enemies, this paper contains the following statement: "The common goldfish and silverfish destroy mosquito larvae and should be put in artificial ponds. Top-minnows of several species have been introduced successfully in several localities and are great feeders upon mosquito larvae. Certain species introduced from Texas into Hawaii have been successful; and a small top-minnow of the genus *Girardinus*, known in the Barbados as 'millions,' has been carried with success to others of the British West India Islands. In Rio de Janeiro another top-minnow has been used by the public health service for placing in tanks and boxes where it was impossible to use petroleum."

IDEM. Some facts about malaria. *Farm. Bull. U. S. Dept. Agr.* (1911), No. 450.

Contains descriptions and figures of the malarial mosquitoes. Suggests that protection may be secured by the use of nets, by screening, and by the destruction of mosquitoes. Quininization of people in malarial districts is also suggested.

KUNTZ, ALBERT. Notes on the habits, morphology of the reproductive organs, and embryology of the viviparous fish *Gambusia affinis*. *Bull. U. S. Bur. Fish.* (1913), 33, Doc. No. 806.

This is an excellent paper on the mosquito fish.

LEPRINCE, JOSEPH ALBERT AUGUSTIN. Impounded waters. A study of such waters on the Coosa River in Shelby, Chilton, Talladega, and Coosa Counties, Ala., to determine the extent to which they affect the production of anophelines, and of the particular conditions which increase or decrease their propagation. Reprint No. 257 from the *U. S. Public Health Reports* (1915), 30.

A study of certain impounded waters in Alabama that were found to contain malarial and other mosquitoes. The debris, floating pine needles, branches, and logs were found to furnish resting and breeding places for the larvae of *Anopheles*. Regarding the destruction of these by natural enemies, LePrince states (p. 11): "Where small top-feeding minnows are present in numbers in the absence of debris, the number of *Anopheles* larvae found at

the sides of floating logs are few, and they are frequently absent in such localities. The scarcity of small fish in the lake during the present year is the reason why many larvæ and pupæ of *Anopheles punctipennis* were present at some of the inlets examined." This scarcity of top-minnows was due to the presence of large predatory fishes. In Shraders Mill Pond, which is well stocked with top-feeding minnows, but which otherwise is ideal for the production of mosquitoes, there being plenty of floating pine needles and débris, no mosquito larvæ were found. "The top-feeding minnows were apparently able to dispose and did dispose of all larvæ and prevented development of *Anopheles* in this area." (p. 9.)

IDEM. Control of malaria. Oiling as an antimosquito measure. Reprint No. 260 from the *U. S. Public Health Reports* (1915), 30.

Comments on the value of oil as used in the fight against mosquitoes and says, "Oiling was largely used in maintaining the force of 50,000 men on the Isthmus of Panama sufficiently free from malaria to construct the canal."

LUDLOW, CLARA SOUTHMAYD. Disease-bearing mosquitoes of North and Central America, the West Indies, and the Philippine Islands. *Bull. U. S. Army Med. Dept.* (1913), No. 4. [Imprint dated 1914.]

This paper gives descriptions and figures of the mosquitoes found in the above regions. Certain desirable lines of investigation are suggested, and as a remedy for these pests, ditching, filling, cleaning, and larvicides are recommended. The introduction of mosquito fish (top-minnows) into ponds and open basins of water is urged.

ROSS, EDWARD HALFORD. The reduction of the domestic mosquitoes. Instructions for the use of municipalities, town councils, health officers, sanitary inspectors, and residents in warm climates. London, J. Murray (1911).

This writer gives the results of his experience gained as health officer at Port Said and in the Suez Canal district. The book contains valuable suggestions.

SEAL, WILLIAM P. Fishes in their relation to the mosquito problem. *Bull. U. S. Bur. Fish.* (1910), 28, 831-38.

This author advocates the use of several kinds of fishes, such as, top-minnows of several species, sunfish, goldfish, the roach, and the pirate perch. Regarding the mosquito fish, *Gambusia affinis*, he says: "As a destroyer of *Anopheles* the writer has for several years advocated the use of *Gambusia affinis*." [See also *Proc. Biol. Soc. Washington* (1911), 24, 91.]

SEWELL, R. B. SEYMOUR, and CHAUDHURI, B. L. Indian fish of proved utility as mosquito-destroyers. Calcutta, Printed by order of the Trustees of the Indian Museum . . . (1912).

This paper gives a list of ten Indian fishes that are regarded as of value in the destruction of mosquito larvæ. These fishes are of the following genera: *Haplochilus*, *Lebias*, *Ambassis*, *Trichogaster*, *Badis*, *Anabas*, *Barbus*, and *Nuria*.

STILES, CHARLES WARDELL. Mosquitoes and malaria. Report on a short trip in eastern North Carolina. Reprint No. 217 from the *U. S. Public Health Reports* (1914), 29.

An account of the locations in which malarial mosquitoes were found, with a list of the species collected.

TOWER, WINTHROP VOSE. A study of mosquitoes in San Juan, Porto Rico. *Circular Porto Rico Agr. Exp. Sta.* (1912), No. 14.

This paper gives a list of the mosquitoes of Porto Rico, their breeding places, the methods followed in mosquito work, and the ordinances recommended with the view of ridding the city of the pest. Ordinance D was as follows (p. 19): "All water in fountains shall be treated with oil or with mosquito feeding fish." Regarding the destruction of mosquitoes by natural enemies this paper states (p. 7): "A number of fish have been under observation, being kept in a large tank. They are very fond of mosquito larvæ and have been seen eating the egg masses of the common house mosquito of the Tropics. The presence of these fish in streams may account for the scarcity of the malarial bearing mosquitoes and therefore the small amount of malaria on the island."

ILLUSTRATION

TEXT FIGURE

FIG. 1. Top-minnow, or mosquito fish, *Gambusia affinis* (Baird and Girard).
a, male; b, female. (Redrawn in the Bureau of Science from
Press Bulletin No. 20, Hawaii Agricultural Experiment Station,
after the United States Fish Commission.)

**PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE,
MANILA, PHILIPPINE ISLANDS—Continued**

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